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Report on a Tour of Inspection in the Wine-growing Districts of Western Europe and Algeria

By
P. Borg

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REPORT on a Tour of Inspection in the Wine-growing Districts of Western Europe and Algeria.

BY

P. BORG

The cost of the investigation has been borne jointly by the Colonial Research Committee and the Government of Malta.

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GOVERNMENT PRINTING OFFICE.
1922.

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Malta
No. 76.

Downing Street.
4th April, 1921.

My Lord,

I have the honour to transmit to you, in original, the enclosed reports made by Mr. P. Borg on the subject of his tours in Spain, France and Portugal, which have been forwarded to me by Lord Blyth.

2. Lord Blyth has suggested that the various reports made by Mr. Borg should be consolidated into one whole in a form suitable for publication and has stated that he is willing to examine such a document before publication with a view to making any final suggestions that may be of value. I should therefore be glad if you would consider the question of inviting Mr. Borg to prepare such a report which might perhaps be published as a sessional paper for Council in Malta. If you agree to publication I should be glad to receive a hundred copies for communication to other Colonies.

3. Lord Blyth has asked that his thanks may be conveyed to Mr. Borg for his reports.

I have the honour to be,
Sir,
Your Lordship's most obedient
humble servant,
(for the Secretary of State)
L. S. Amery

Governor
Field Marshal
Lord Plumer, G.C.B., G.C.M.G., G.C.V.O.,
etc., etc., etc.,

251515

Malta.
No. 18

Downing Street.
17th April, 1922.

My Lord,

With reference to Mr. Robertson's letter of the 20th of December to Lord Blyth, I have the honour to transmit to you two .copies of Mr. Borg's report on a tour of inspection in the wine-growing districts of Western Europe and Algeria.

Lord Blyth in a letter to his Department states that such great changes in wine-making have taken place during the past twenty years that none of the books that were written in the past century are really up-to-date, and are therefore not safe guides in the information they impart regarding the production of either natural or fortified wines and expresses the opinion that Mr. Borg's report when properly printed will be of the greatest value not only to the new regions that may be developed, but also to countries like Australia and South Africa which need experienced knowledge in the making and preserving of wines.

I have the honour to be,
Sir,
Your Lordship's most obedient
humble servant,
Winston S. Churchill

Governor
Field Marshal
Lord Plumer, G.C.B., G.C.M.G., G.C.V.O.,
etc., etc., etc.,

THE object of this report is to collect together and digest a number of preliminary notes and fragmentary information collected by me during a tour of inspection to the wine-growing districts of Estremadura, the Alto Douro, Jerez de la Frontera, Malaga, Barcelona, Reus and Villafranca, Bordeaux, Algiers and Tunis, undertaken on instructions from the Government of Malta on behalf of the Imperial Research Committee. The object of this tour was principally to collect information concerning the manufacture of the liqueur wines of Portugal and Spain, and to get an insight into their manipulation, with a view, possibly, to establish a liqueur wine industry in the British Colonies and in the Mediterranean, with Malta as its headquarters; but its scope has been extended to include the best table-wine centres of the countries mentioned and also of France, Algeria and Tunisia, in the hope that the information collected would prove useful to the proposed establishment of the wine-industry in the Maltese Islands, as well as to other wine-growing districts of the Empire outside the Mediterranean.

In this report the viticulture and wine-industry of the several districts inspected are dealt with separately. The methods of cultivation and of wine-making in each district are thus more easily compared, and useful hints obtained for the cultivation of the vine and also for canteen operations in lands having similar soils and climate. I have been careful to note the more important sorts of vines grown for the production of wine in each district. It is generally admitted that the fundamental condition for successful wine-making is the type of vine which is grown, although I am, of course, fully aware that the same vine, submitted to the same methods of cultivation and to the same processes of wine-making may produce different wines in different districts, and that vice versa, various vines of approximately similar quality grown in the same district may pro-

duce wine of the same type, as is the case in the Alto Douro. No doubt, the influence of the soil and climate, and possibly of special local forms of wine-ferments, play a very important part in the manufacture of wine, but the fact remains that frequently, apparently insignificant modifications in the manipulations have had the effect to modify considerably the part played by the influence of soil and climate and to produce wine of altogether a different type from that usually obtained.

This report has no pretence to impart instruction in Viticulture and Oenology. This knowledge on the part of the reader is presupposed and, therefore, reference is here made only to particular methods and processes, in so far as they are believed to have an influence on the type and quality of the final product. It will be seen that many of the methods and practices referred to are mostly still as primitive as they were when the types of wines concerned were first placed on the market and acquired their well deserved celebrity. I am describing them as they are, and, no doubt, the reader will find no difficulty to suggest at once some lines of improvement. However, I need hardly point out that the flavour, bouquet, finesse and other qualities to which a type of wine owes its fame are so easily affected by a change of process, and their origin and permanence is so little understood, in fact, notwithstanding their paramount importance, they are so little understood, that it would be very risky to introduce improvements, before making extensive trials prolonged for a series of years.

In all the places visited by me, the tendency is everywhere to stick to the simplest and most elementary methods. In fact, the complex processes usually detailed in standard works are completely eliminated, and appear to have but small utility in actual practice. In many factories in which standard wines are produced, old methods are again resorted to and with trifling exceptions, which I have been careful to note, the modern apparatus which has been installed from time to time, has been kept idle for years or allowed to fall out of gear, after a brief period of unsatisfactory experience. It is only in Algeria and Tunisia, where vintners have to deal with large crops, which must be handled in a comparatively short period, that machinery of an improved type is extensively employed in order to save time and

labour. I am not here referring to the refrigerating and sterilising apparatus, which owing to the special climate conditions appear to be indispensable to the Algerian vintners, but to ordinary press and canteen apparatus of generalized character.

In all countries, the fine wines appear to owe much to the methods of keeping and ageing, and accordingly the details of the manipulations which they receive in the cellars are carefully noted. A description of the cellars themselves is likewise often added and although some of the details may appear to be of trivial character, great importance is attached to them by the vintners, and scrupulously followed in all new constructions in the same district. Thus to cite one example, the Solera system is now adopted very generally in the maturing of sherry wines throughout the whole sherry district. I am not aware that this system, which, after all is a very simple process, as will be seen later on, has ever appeared in print, and, in fact, is looked upon as a great secret by the manufacturers.

The manufacture of brandies and the production of dry grapes or raisins is at present engaging a considerable share of attention, particularly in Andalusia, and both processes are here briefly described, consistently with the scope of this report.

Valletta, 1st September 1921.

P. Borg

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WINE-GROWING IN WESTERN EUROPE AND ALGERIA.

METHODS OF VINE-CULTIVATION IN FRANCE, PORTUGAL, SPAIN AND ALGERIA.

FRANCE. — In no other part of the world is Viticulture better exemplified than in France. This country may be considered as one big vineyard from the Pyrenees to the Rhine. In France, however, wine-making is not an industry but an art, and this has brought about that parcelling or subdivision of the French vineyards which is the primary cause of the excellence of their wines. Every vineyard has its own particular type of wine and, although these wines can be grouped altogether into classes, they do not lose their individuality. It is, moreover, the ambition of every vintner to improve his particular wine, by applying the experience gained from day to day, either in the shape of new devices or of fresh precautions. Such an intense competition would lead one to expect that Viticulture has long since been abondoned in the less fortunate districts; but this is not the case, as the French vintner always finds a ready market for his «vin ordinaire» which even under unfavourable circumstances compares well with many good wines abroad.

The most important vine-growing centres of France are the Marne, the Côte d'Or and the Gironde. « Champagne with foaming whirls » must always remain inimitable in charm and extravagance. It is grown on a poor, calcareous earth of tertiary formation and made from both red and white grapes, chiefly PINOT NOIR and PINOT BLANC or CHARDONNAY. It is from the latter that the wine derives its particular « finesse » and lightness. Burgundies are remarkable for their « bouquet » and their clear, rich, red colour. The most celebrated vintages are Baume, Volnay and Pommard, and their best vineyards are grown on a low ridge of hills separating the Seine from the Saône.

It is however with the Bordeaux Wines that Englishmen are more nearly concerned. The best known of these wines are the *Medocs*, the *Graves* and the *Sauternes*. Wine, however, which is offered solely as Medoc or Sauterne is a nondescript vintage which is difficult to determine. There are many vintages in both the Medoc and the Sauterne districts and each vintage, as already stated, has its own individuality.

The Medocs. — The Medocs are grown on a level piece of country on the left hand bank of the Garonne, from Bordeaux

to the sea. The soil is largely clayey or mixed with gravel and the latter predominates in lands which produce the best vintages. The vintages are usually distinguished by the name of the Château or Commune to which they belong and form five distinct classes, the first of which includes Château Lafite, Château Margaux, Château Latour and Château Hout-Brion.

The grapes from which the Medocs are made are Malbec, Merlot, Cabernet-Sauvignot and Petit vertot. The American stocks upon which these are grown are:

Riparia-Gloire de Montpellier, on sandy soils;

Riparia x Rupestris 101/14, on clayey soils; and

Rupestris Monticula or Rupestris du Lot on calcareous soils.

The latter keeps a more vigorous vegetation, but is less productive, owing perhaps to its excessive vigour.

Before planting new vineyards in the Medoc district, the land is always trenched 50 cm. deep and a layer of manure is spread on the bottom. The manure employed, called « Compost », consists of a mixture of cow's manure and soil in approximately equal parts and well matured in the shade. The American stocks, grafted with the desired variety, are then planted in rows against pine-wood posts firmly set in the soil, and supporting one or two wires 40 or 50 cm. apart, to trail the vine upon. These posts serve also to direct the pruning, which is made during December and January. Each vine is left on four stocks, two of which bear the fruiting branches. In March or April the vineyard is ploughed by running a « faceon » or farrow close to the vines and partially exposing the roots. After a day or two a top-dressing with superphosphate is applied and a second « faceon » or farrow replaces the earth, covering the stem by three or four inches. This operation is repeated again with a dressing of « guano » or ashes in July or August, immediately before the setting of the rainy season.

The vines commence to bear fruit by the 4th. or 5th. year and retain their vigour and fertility for about twentyfive years and then they usually either become unproductive or die. As a rule between the fifth and the twentieth year the production of the vineyard is at its best.

The Sauternes. — The Sauternes are grown on all sorts of soil. The American stocks which have given the best results in this district are Berlandieri x Riparia 420A for calcareous soils, Riparia-Gloire de Montpellier and Berlandieri x Riparia 420A for clayey soils and Rupestris du Lot for moist sands, but the vigour of this last graft-bearer on such soils is detrimental to its productivity. The vines receive much the same treatment as in the Medoc. A dressing with superphosphate is given in March or April and a dressing with ashes, « Compost » or « guano » is given in December or January. Pruning is conducted on the

four-stock system or the two-stock system. In the latter case the vines are trailed up a pole three or four feet high.

The Sauternes are made from Semillon and white Sauvignon grapes in a « pourri » state. No other white grapes are grown in the Sauterne district. The « pourri » condition is brought about by the growth of a fungus, « Botrytis cinerea » on the berry. This fungus, which is dreaded on other grapes in other countries, absorbs moisture from the berry and increases its sweetness by the concentration of the juice and by the destruction of crude principles which serve for its nourishment. It is thus responsible for the peculiar « bouquet » of these wines.

Spain. — In Spain viticulture tends to gravitate in well defined districts. Thus we find the Sherry district and the Malaga district in Andalusia, covering each a few hundreds of hectares of land. Higher up, along the coast of the Mediterranean, we find successively the Alicante district, the Muscatel region of Valencia, the Tarragona district and the Priorato and the Panadés districts in Catalogna, with much more extensive vineyards. The Mancha wines are grown in a vast region between Toledo and Ciudad Real, reaching eastward as far as Alcaraz; and the Rioja wines are the unclassified produce of a large area embracing Lograno, Pamplona, Aoiz, Egea, Cortes, Torrecilla de Camer and San Domingo de la Calda.

The varieties of grapes cultivated in Spain number several hundreds, but most of these are mostly used as table grapes and are never met with forming extensive vineyards. A variety called Planta with large, oval, white berries, having a thick rind, is worth mentioning as it ripens in December. The varieties most frequently employed in the making of table-wines are :

For red wines — Morastel, Sumoll, Aramon, Tempranillo, Garnacha Roja, Carinena and Trepat.

For white wines — Xerello, Parellado, Pansé, Macabeo, Garnacha blanca and a vine known by the letter H.

Morastel and Xerello yield the superior types of wine, and Sumoll and Macabeo the ordinary wines. Garnacha blanca is largely employed for the preparation of sweet wines some of which are used only for blending.

In the Sherry district the vines or cepages grown are Palomino, Mantuo Castellano and Mantuo de Pila on sandy soils and Beva, Black Castellano, Sevillano and Mollar on other soils. Pedro Ximenes is also cultivated in this district but does not enter into the composition of the best Sherries.

In the Malaga district the vines chiefly grown for wine-making are Pedro Ximenes and Muscatel.

Most of the vineyards of Spain are planted on clayey soils, and it is only in the Catalogna district that vineyards growing

on calcareous soils predominate. The lands generally selected for vineyards are level lowlands, or terraced valleys. The soil receives much the same treatment everywhere before planting. A powerful, broad plough, drawn by means of an erect windlass worked by four pairs of oxen breaks and upturns the soil in one operation to a depth of one meter. This operation is made in September, so as to allow time for the soil to become mellow and for the rain to break up the sods. In the following January, the American rootlings, two years old, are planted in rows three or four feet apart. The stock usually employed is Berlandieri x Riparia 420A, Rupestris du lot or hybrids of these. Berlandieri x Riparia 420A and 420B have given the best results on clayey soils. In the following winter the rootlings, now perfectly established, are grafted with the European varieties, and the vines begin to produce a good crop by the second year. Thus the first crop, and a considerable one too, is obtained in three years. The maximum production is reached by the fourth year after grafting. Every winter the ground is ploughed lightly to break up the surface, and every third year the vines receive a liberal supply of farmyard manure in shallow trenches worked between the rows. There are various systems of pruning. The « taille en courson » is universally followed in Andalusia, but in the North and East almost every method practised in France, is employed. In Catalogna the four stock system or bush-system « á quatre bras » predominates, and in the vicinities of Reus and Tarragona many vines are trailed horizontally « en cordon ». A method followed by the School of Viticulture of Reus, which has been adopted in many vineyards, consists in growing the vines on two branches, one of which disappears the following year and is replaced by a new formation. This is known as the « spiral system ».

PORTUGAL. — *The Ports.* — Ports were known and appreciated very early in European History, but it was only during the seventeenth century that port-wines came into prominence, particularly with English consumers. At that time a few English settlers began to extend the vineyards in the Douro region; British ships made frequent calls and created a demand for port-wines which could be met only be extending the vineyards and developing the wine industry.

It appears, however that at first the new plantations were not much of a success. Those planted on the lower Douro in particular, produced harsh wines, although both the vines grown and the methods of cultivation were then the same. In this way originated the «Vinhos Verdes» to which reference will be made further on. The valley of the Douro and the country around for many hundreds of square kilometers now form one big vineyard, subdivided into clearly marked sections, each of which generally produces only one type of wine. Thus besides port-wines and the « Vinhos Verdes » we find Grandjo, Evel Ermida, Familia, etc. which are all table-wines of fairly good quality, some of them

being only a blend, while others are still in an almost experimental stage and practically undeveloped. Thus in this vast wine-growing region we have a clearly defined Port-wine growing area, between Regoa and Pocinhao within the valley of the Douro and then we find the district of the « Vinhos Verdes » on the Lower Douro. There is also a district which is an extension of the port-wine district of the Upper Douro, producing the table-wines above mentioned, none of which has as yet established a reputation of its own.

We find the same thing in Estremadura around Lisbon. The most interesting wines produced here are Colares, Arinto, Serradyres, of which there are both red and white sorts, and a good white table-wine called Bucellas. The most important of these are the Colares wines which are grown on the right hand bank of the Tagus, particularly around the town of Colares, betwen Cintra and the sea. The red wines are made from Rámisco, « casta regional de Colares », a local seedling, and the white wines from Fernao Pires. It appears that on the left bank of the Tagus the conditions for successful wine-making are less favourable, as much of the fermented must is distilled at once. Here the most important wine produced is Bucellas, the light white wine above mentioned. The failure to produce a standard wine on a large scale in this vast vine-growing region has brought into existence huge distilleries, which form a very flourishing industry and supply most of the alcohol required for the manufacture of ports, as well as for exportation. As a side line, Mistelle wines of some importance are also produced on a vast scale. Among these there are Muscatel, Porto do Sud and the much more interesting wines Abafado and Beneficiado.

There are numerous vines or cepages cultivated in Portugal for the manufacture of wine. On the Douro the most important in the production of ports are :

For Red Ports — Alvarelhao, Cornifesto, Touriga, Souzao, Tinta amarella, Tinta Cao, Tinta Carvalha do Douro, Tinta Francisca and Albino de Souza, the first four being remarkable for colour and acidity.

For White Wines — Donzellinho branco, Rabigato respiqueiro, Codega and Gouvejo.

These grapes are generally vintaged as they come to the « lagars » and are not crushed in any defined proportions. Bastardo and Donzellinho do Castello are two cepages or vines which were formerly cultivated on an extensive scale and the produce of which constituted by far the largest proportion of the vintage. Many old and excellent ports are still the produce of these vines. However, as they ripen too early, when the temperature is still too high for a proper fermentation, they were gradually abandoned and replaced by late-ripening sorts; but they are desirable cepages for the production of Port or a si-

milar wine in warm climates, provided that proper means are taken to keep down the temperature of the fermenting must.

The « Vinhos Verdes » are of two types, viz : red and white. The first is made from Izal grapes and the white from Fernao Pires, which vines do not appear to be capable of producing good wines in the North of Portugal.

In Estremadura, white Porto de Sud is made from Fernao Pires, Arinto, Boal and Moscatel Setubal mixed together in any proportion. The Moscatel Setubal is also used in the preparation of Moscatel wine; while the Beneficiado and Abafado wines are both made from Malinha and Joan Paolo, with some modification in the fermenting process.

The Viticulture of Portugal presents many striking features which may vainly be sought for in other wine-growing centres. On the Douro, Nature has contributed largely to the success of viticulture, and very little is due to human agency; while in the South, especially at Colares, we find the diligence and ingenuity of the viticulturist taxed to its utmost. At Rio Frio, on the left-hand bank of the Tagus, there is one of the largest and best kept vineyards in Europe, owned by a single individual, Mr. Antonio dos Santos Jorge.

Up the Douro. — It is only by going into details that a comprehensive idea can be formed of the conditions ruling and the labour employed, as well as the way in which geographical and geological conditions sometimes further the aims of the industry.

The Douro runs over a broken hilly country, mostly composed of bare slate-schists, in a tortuous narrow calley, closed on all sides by slanting, almost perpendicular rocks of no great elevation. In summer it shrinks to a tiny stream, hardly navigable to the small boats of the district, but in winter it is greatly swollen by the rains and often reaches a height of seven meters above its ordinary level. This flooding is a periodical occurrence and is in itself a sign that the incidence of the rainfall has been normal.

The soil consists of the debris of the rocky formation above mentioned, as a result of weathering, and in some places the layer of arable soil is only a few inches deep, but in a few localities this layer attains a depth of three feet or more. Beneath this layer, the subsoil consists of stones and fragments of schists, often reduced to a condition of thick angular gravel, and offering suitable conditions for the development of deep root systems.

The river in its lower course to the west is exposed to the western winds which bring in from the Atlantic a heavily salted spray, while the prolongation or jutting of its left bank into a promontory beyond the coast-line is conducive to render the river navigable with northern winds, for small sailing craft.

The whole valley as far as Procinhao is well cultivated, but it appears that cultivation was more extensive and better understood in past days. All the fields consist of terraces spreading about one-third up the hills, obviously for the scope of retaining the soil and preventing its gradual denudation by the action of rains. Unhappily many of these terraced fields are at present in a dilapidated condition, with the result that the soil is being continually washed down the river, in winter, and carried to the sea.

The bare tops, hardly covered by a few inches of soil, with projecting rocks cropping here and there, support luxurious pine-plantations, which yield timber for construction purposes, as well as for posts and supports in the vineyards. The lower fields along the valley are generally devoted to the cultivation of the vine and the olive, this cultivation being by far the most important in that district. Higher up, along the slopes of the hills and on poorer lands, there are extensive plantations of « sobreiros » or cork oaks.

Frequent and abundant showers in autumn commencing from the close of September, saturate the soil and the subsoil. This period is followed by a cold frosty winter. Spring is generally fair and warm, and in summer the average temperature in the sun is 48oC. The almost periodical showers during the autumn and early winter keep the river properly flooded throughout the whole rainy season and until spring.

The rains are rarely of a heavy nature so as to imperil the terraced fields, and break down the retaining walls, washing off the soil into the river, although heavy down-pours occasionally take place with more or less disastrous results. The average annual rainfall for the last ten years has been 25 inches.

Again the frosts help to break up the thinly stratified schists, opening up new channels for the absorption of water and adding continual fresh material to the soil. In summer the surface of the soil becomes baked, but the deep roots continue to enjoy the benefits of the moisture, which had accumulated in the lower layers during the rainy season.

The Douro has been famous through many centuries for its port-wines. There is no wine in Portugal or elsewhere that can compare with fine port either in « bouquet » or body. What are the exact causes which give to port-wines this pecularity it is not easy to determine. Port-wine is made and has been made all along, from large and variable mixtures of grapes in very variable proportions. Some of these cepages are no longer under cultivation on the Upper Douro and have been wholly replaced by others; notwithstanding port-wines have lost none of the fragrance and other characteristics to which they owe their celebrity. Again, there are many soils in Portugal closely resembling, if not exactly identical with, those prevailing on the Upper Douro, and the same cepages which produce the port-

wines of the Douro have been cultivated there and elsewhere, but invariably their produce was anything but port-wine. Moreover in their native land on the Douro, port-wines are prepared in such a casual and careless manner that their qualities cannot be ascribed to skilled manipulations in vintaging.

Still there are factors which undoubtedly play an important part in the making of fine ports. The climate probably exercises great influence on the maturation of the fruit. The excessively cold winters throw the vine into a practically perfectly dormant state. This state brings about a reaction in Spring, made manifest by a vigorous growth, capable of better resisting cryptogamic infections and other diseases. A normally fine spring mantains this healthy growth and materially assists in the development of those substances to which the excellence of the final product is chiefly due. At the same time the cooling showers of autumn, which commence just as the fruit approaches maturity, prevent the berries from becoming quickly over-ripe and losing their aromatic qualities, and thoroughly washing the berries from injurious elements and organisms which might otherwise lead to an unhealthy fermentation. The effects of this cleaning action of the rain are clearly shown by the fact that very often the must takes a comparatively long time to start a vigorous fermentation. Moreover, the possible action of special or local forms of ferments should not be lost sight of.

The methods of cultivation play also an important part in the making of the final product. The basin of the river, from the point of view of vine cultivation, can be divided into two districts, the Lower and the Upper Douro. In the Lower Douro, where the district extends up the river as far as Regoa (106 kilometres from the sea) the climate is practically temperate throughout the whole year, and in this district no port-wines are produced or could be produced, their place being taken by the Vinhos Verdes above mentioned. The Upper Douro district extends from Regoa to Pocinhao (175 kilometers from the sea) beyond which the cultivation of the vine practically ceases altogether. This district, which is the home of port-wines, can be subdivided into two others, viz : the Lower and the Upper Cargo, the finer port-wines being made exclusively in the Upper Cargo, where the climate and the other conditions above mentioned are at their best.

In the Lower Douro, there is an extensive cultivation of the vine from Porto to Cahide (49 kilometers) and Villamea (54 kilometers) and then becomes more sparse throughout the rest of the Lower Douro to Regoa. The vines generally grown here are Bastardo and Izal with a fair proportion of the vines or cepages ,which in the Upper Douro are cultivated for the production of genuine ports; but here the wines produced belong mainly to the class of Vinhos Verdes. Here the vine is chiefly cultivated on pergolates, four to ten feet high, made of

wire stretched on pine poles or stone pillars, forming extensive vineyards in sheltered situations, but in the more exposed parts running only along the low partition stone walls of fields.

From Villamea (54 kilometers) to Porto de Rei (91 kilometers) the cultivation declines into sparsely cultivated patches of no great significance. Here the vines are commonly « married » to trees, being generally trailed on oaks, sobreiros or cork-oaks, olive trees and Eucalyptus trees, or on dead branches of these trees, five to six feet high, fixed into the earth. In some places these trees are replaced by white poplars, planted with hardly any regularity for the trailing of the vines.

Between Barqueiros (95 kilometers) and Regoa (106 kilometers) there is a region of intense vine cultivation occupying the fields along the Douro Valley, which here begin to assume more generally their peculiar terraced appearance. The vines are here trailed on pergolates, only about two feet high, in rectangular patches of variable size, while pergolates ten feet in height run along walls and other sheltered situations. This system of cultivation continues upwards from Regoa and Tua as far as Pocinhao (175 kilometers) which marks the limits of the vine-growing district in the Upper Cargo.

Both the Lower and the Upper Cargo are regions of « quintas » or properties of variable size, each having its vineyards and factory. Everywhere the vines are cultivated on pergolates, as at Barqueiros, but there are numerous plots in which the pergolates are erect, like the French espalliers, one meter apart and therefore allowing more easy passage between them.

From Tua (145 kilometers) to Pocinhao (175 kilometers) are the most renowned vineyards or quintas : Vargellas (156 kilometers) and Vesuvio (162 kilometers) producing the best port-wines of the district. As regards cultivation this is conducted on the same lines as those mentioned for the other districts.

Here I may remark that the trailing of vines on pergolates has a double object, viz : to prevent the fruit from reaching the ground and getting soiled, and secondly to protect the ripening branches from the glare of the sun by the light and cool foliage of the vine itself.

All along the Douro, there appears to be only one ruling system of pruning and trailing the vine, namely the « Royat » (Jamin) method, except when the vines are allowed to climb up the trees in a natural way, a system which is largely developed also in Italy.

It is a strange fact that although the cultivation of the vine extends over 175 kilometers along the valley of the Douro, only the uppermost 32 kilometers of these produce the true ports, the lower 106 kilometers yielding no true ports at all, but only crude wines of a special type (Vinhos Verdes), and considering the limited width of the valley and the narrowness of

the strips of terraced land cultivated on its banks, intermingled here and there with large plots of waste or neglected land, it is astonishing how such a limited area of ground under vine could attain such renown.

Colares. — Next in interest and importance are the vineyards in Estremadura at Colares. These vineyards cover 3,000 Hectares of land, mostly divided into small allotments among the farmers. A central factory, owned by the « Companya dos vinhos ed azeites du Portugal » works practically all the wine of the district. The vineyards extend from the limits of Cintra to the sea, over an irregular, undulating ground, covered by a thick layer of a very loose sandy soil, often five or six meters deep. This layer of sand gives to the viticulture at Colares its most salient feature. As Phylloxera is not known to cause much injury to vines growing in sandy soils, the vines here are all growing on own roots, that is ungrafted, in spite of the fact that the region has been long known to be infested with Phylloxera. As however, the vine requires a firm soil to take root and establish itself, the vines at Colares are planted in the subsoil at the bottom of holes dug often five or six meters deep, that is, through the whole surface layer of sandy earth. The vine is made to grow up from this depth with a single stem, gradually earthing the soil to fill the hole, and then the plant is allowed to spread over a considerable area. The branches trailing on the surface of the ground, often emit adventitious roots about 15 c.m. long, in a series, like the rootlets of an ivy, which give it a firm hold on the sand. The vines are necessarily planted very wide apart, and therefore are not subjected to short pruning but are allowed to spread in order to make up for the deficiency in number. The fruiting canes are supported on pegs or props about 30 c.m. above the ground, to keep up the fruit, and prevent it from getting soiled.

Rio-Frio. — The vineyards at Rio-Frio are more remarkable for their great continuity and regularity. These vineyards extend for about 12 kilometers on a broad and level plain from a little beyond Pinhal to Poceirao, and stretch in a continuous plantation for from five to seven kilometers. The soil is white, sandy earth, in some places mixed with clay. The varieties of grapes grown are Pirichetta, Ramisco, Mortera, Malinha, Joan Paulo and Moscadello, prevailing in the order given. Over the whole vineyard a vast number of « sobreiros » or cork-trees, are planted in rows, five or six meters apart. These, at the same time that they break the rays of the sun, and afford protection to the ripening fruit, are a source of considerable income as a side industry for the supply of cork. Here also the vines are growing on own roots notwithstanding the presence of Phylloxera, and the earth is everywhere kept heaped up for from 20 to 30 c.m. around the stems of the vines as a protective measure against Phylloxera. This measure is made necessary by the fact that the sandy soil is not deep enough, in most parts hardly

exceeding one meter, and without this operation the Phylloxera would reach the surface roots around the stem and destroy the vine.

The vines are, therefore, propagated directly by cuttings about one meter long and these are planted from 60 to 80 c.m. deep, in accordance with the practice in all warm climates.

Algeria. — The best vineyards of Algeria are found in the hilly districts of the Tell region along the coast, although those growing on the plains are second to none in either production or vigour. The American stocks recommended by the School of Agriculture of Algiers for grafting with European varieties are :

Berlandieri x Riparia 420A, for soils containing not more than 50% of calcium carbonate.

Chasselas x Berlandieri 41B, for soils containing more than 50% of calcium carbonate, and

Rupestris du Lot for poor lands and soils of dubious constitution.

All three stocks have given very good results, especially Rupestris du Lot, which has proved itself eminently suitable for all soils in Algeria, and has proved highly resistant to Phylloxera.

Other grafting stocks formerly much used, such as Aramon x Rupestris Ganzin No. 9, Mourvedre x Rupestris 1202 and Bourriquon x Rupestris 93-5, are being gradually abandoned. There are still many vineyards, the vines of which are growing on these stocks, but their resistance to Phylloxera is evidently of a low order, and such stocks, moreover, proved unsuitable for the warm climate as well as for the poor lands and calcareous soils of Algeria.

The European cepages cultivated for wine-making are :

For Red wine — Carignan, Aramon, Cuisaut, Grenache, Alicante, Grand Noir de la Calmette and Morastel.

Carignan yields by itself, about one-third of the total produce of black grapes in Algeria and is the basis of all red Algerian wines. Aramon and Cuisaut represent each about one-sixth. Cuisaut and Grenache are particularly valuable as they impart alcoholic strength. The wines are not vintaged from particular selections of grapes but from such grapes as come to hand, largely mixed with Carignan.

For White Wines — Clarette pointue, Clairette egreneute, Aramon blanc, Macabeo, Semillon, Sauvignon and Ugni Blanc.

Clairette pointue is the most important; it represents about one-half of the total produce of white grapes, and forms the basis of all white wines. It also imparts alcoholic strength. Clairette egreneute is an indigenous cepage and stands next in importance.

This list includes only a few of the grapes grown in Algeria, but all Algerian wines are produced almost exclusively from these cepages.

The vineyards are often distinguished as « vignobles de plain » and « vignobles de coteaux ». These last produce the best wines. The « vignobles de plain » are planted chiefly with Aramon, Cuisaut, Carignan, Alicante-Bouchet and Cot de Cheragos, while Carignan, Cuisaut and Alicante-Bouchet are the principal cepages of the « vignoble de coteaux ».

Pruning is practised in three different methods. The « taille en cordon » is usually followed on the plains, either on the « Royat unilateral system » or as a « taille Cazeneuve ». On the hilly districts preference is shown to the « four-stock system » (4 à 8 bras), and to the « taille à goblet ». On the plains the vines pruned on the cordon system are trailed on erect supports, about one meter high, with wires running 40 c.m. apart.

Nurseries. — Before closing this heading on the cultivation of the vine in Algeria and Western Europe, it will not be out of place to make some reference to the propagation of American stock. One of the largest and best equipped nurseries for this purpose is the « Pepinière Sabaté at Fort de l'Eau », Algeria, of which the annual output is calculated at

15,000,000 grafted vines
5,000,000 rootlings, and
30,000,000 cuttings.

Most of the rootlings are grown exclusively for exportation and more than 35 different varieties of stock are cultivated. Propagation is largely made from cuttings. These are prepared in January, but are usually planted in April; in the meantime they are kept buried in the soil, upside down, with a view to encourage the formation of callus on the wound just below the lower node. Those varieties which are more or less difficult to propagate by cuttings are usually propagated by « marcottage ». The « marcottage Chinois » is adopted for this purpose as it permits of a number of finely rooted plants being taken from each cane.

Grafting is done in April by the whip and tongue graft, chiefly on cuttings, which are planted about 25 c.m. deep in close rows and after receiving careful attention throughout the spring and summer, are ready for sale in the following autumn. The average of failures is only about 30 per cent.

In this connection I may point out that grafting in place by the ordinary cleft graft is done only on a limited scale, as most growers prefer to purchase and plant one or two-year old grafted vines, and thus avoid the grafting operation and perhaps secure an earlier production. However, grafting in place should be preferred for new vineyards, if skilled labour for grafting is available. This method is stated to ensure vines of greater vigour and productiveness, besides making sure of the

identity of the stock, and saving the greater cost of the grafted plants. To follow this method the American rootlings are first planted in their place in the vineyard to become well established, and in the following year they are grafted close to the ground with the ordinary cleft graft and one or two budded scions. The earth is then heaped over the graft (buttage) and in the next winter the young graft is cut down to the lowest good bud, in order to build up the vine.

The « herbaceous graft » is generally condemned in Algeria, on the assumption that the very perfect knitting ensured by the graft always results in some slight modification of the grape, which imparts to the wine produced from it some of the objectionable qualities of wine from the fruit of direct bearers.

The preparation of the soil for the reception of grafted cuttings involves a threefold operation, viz : trenching, manuring and ridging « buttage en chasseuses ». Trenching, 40 to 50 c.m. deep, is done in November or December, and a layer of chemical manure, ashes or well matured farmyard manure is spread along the bottom of the trench. The soil is then left to itself until April, to settle and to be acted upon by the atmosphere, and then the grafted cuttings are planted in rows 2.50 meters apart. Ridging or « buttage en chasseuses » is then practised, both to protect the grafts and to regulate the drainage. Although the same land is again planted with grafted cuttings the following year, trenching and manuring are done only every two or three years, thorough ploughing being carried out instead.

Bouture herbacée. — The adaptability of Vitis Berlandieri and of its selected forms to high calcareous soils, and the difficulty which is generally experienced in their propagation by cuttings in the ordinary way has induced Mr. Castet, on the suggestion of Prof. E. Vivet, to try their propagation by herbaceous cuttings, « bouture herbacee ». The first trials with this method of propagation were commenced in 1912, in the Jardin d'Essai at Algiers, with very encouraging results, and this method is now being quickly adopted.

By this method « bouturage » can be practised in both winter and summer. In winter, the cuttings made from tender branches, on fine days with bright sunshine, are planted in pots and kept in a green-house the temperature of which is kept as constant as possible at 15o C. The cuttings take in about a month and may be grafted in April. In summer the cuttings are made throughout the whole season from the growing branches, and planted in partially shaded situations, under hay or bamboo sheds, in glass-topped boxes. They develope fully in about forty days and are grafted the following year.

Tender shoots with three or four leaves are taken, practically at any time from April to September, the lower leaf is removed by a clean cut, and the tender stem is also cut cleanly just below the last node. The cuttings are not allowed to flag, but

should be planted immediately, and in the meantime may be kept in water or covered by a wet cloth. They are planted in pans or broad shallow pots, as many as the pot will hold, planted rather close together, and stuck about 5 c.m. deep. The compost should be preferably a sandy loam, but ordinary garden soil will do, provided that it contains no fermentable materials. The pans or pots should be placed under glass or in a glass-house, shaded off from the sun, and kept preferably moist by very light sprayings morning and evening. In a month's time the cuttings will be properly rooted and the pans are taken out in the open and kept in the shade of trees or in other shaded and sheltered situations, such as in bamboo or cane sheds, so that the young plants may harden thoroughly. They are then planted out separately in rows in the nursery either in the course of summer or in the following winter, and may be grafted in the following spring.

CLARETS AND SAUTERNES.

CLARETS. — In Western Europe the theory and practice of wine-making is nowhere better exemplified than in France, and more precisely in the Medoc District of the Gironde. The Medocs represent simplicity itself, combined at the same time, with all that is perfect. Art does not interfere in the making of the Medocs, and the vintner's skill is only taxed in so far as precautionary measures are concerned.

The Medocs are typically fine, soft, red wines, with a characteristic bouquet and a delicate taste. They contain from 10 to 11 per cent of alcohol.

The vintage is purposely delayed until the wet weather has definitely set in, and abundant rains have saturated the soil. This period usually falls between the 27th September and the 13th October, the mean temperature being then almost stationary, at from 18o to 12o C.

The vintage is preferably performed on a fine day. The grapes are picked by hand by a pair of scissors and collected in wooden trays, and are then transported to the factory in large iron drums on carts drawn by oxen. On arrival at the factory, each cart-load is emptied into the stemmers or stemmers and crushers combined, which remove the stalks and also crush the grapes. The crushed grapes along with the juice are then passed into the fermenting vats, without further pressing. The fermenting vats are usually made of oak and have a capacity of 150 hogheads each, but cement vats, lined with glass, are also in use and have many supporters. The vats, however, are so constructed that all access of air can be excluded during fermentation.

AIR VALVE.

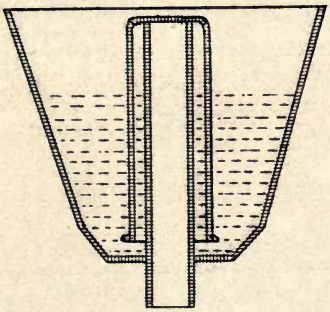


Fig. 1.

The crushed grapes are allowed to ferment in these vats and are kept out of contact with the air by means of a special apparatus, for two or three weeks, by which time all the sugar is converted into alcohol. The supernatant liquid is then drawn off and the marc pressed to extract the « vin de première serre ». The two liquids are mixed and the young wine is stored away in a cool place in hogshead casks (of 225 Lt. ea.) lightly bunged, but carefully kept full by frequent inspections. The « vin de seconde serre » is set apart to form secondary wines.

Young wines are always stored by themselves and usually in a cooler place than the older wines. The temperature in the cellars of the Medoc district where young wines are kept until the second «soutirage» is generally from 10. to 0o.C. The first « soutirage » takes place in December or January, the second in March or April, the third in July or August and the fourth in October or November. From March and April the wines can stand a temperature of from 10o. to 20o. and even more in the cellar, without suffering.

After one year the wines may be considered old and are transported to another cellar, to make room for the new wines. These cellars usually have a temperature of from 15 to 20o. C. They are kept scrupulously dark and all smells avoided. They are also occasionally disinfected by the fumes of burning sulphur; smoking is not permitted, and candle or electric light is used when light is required for manipulations. The casks are now properly bunged and set in an inclined position so as to wet the cork and reduce evaporation; devatting is practised only twice a year, that is every six months in order to remove the lees, care being taken to move the wines only in fine weather.

Fining is usually made just before the young wines are removed from the first year's cellar. Gelatine or isinglass is employed at the rate of from 20 to 25 grammes per butt according as the wine has 10 or 11 per cent of alcohol. The treated wine is allowed to settle and clarify for one month before devatting.

Clarets having less than 11 per cent of alcohol are generally consumed as « vin ordinaire » as soon as they are one year old; those having 11 per cent are bottled when they are three years old in wood, and are at their best between the 10th and the 20th year.

The apparatus formerly employed to keep the fermenting must out of contact with air consisted of a U bent tube with one end fixed into the vat and the free end immersed in a basin of water. The apparatus used at present is a modification of the same principle. It consists of a tin basin through which passes a tube, the upper end of the tube being covered by a sliding cylindrical cover. The basin is kept half full with water and the internal pressure lifts up the cylindrical cover, thus permitting the exit of gas through the water. (Fig. 1).

New casks are prepared by treating with a 2% (20 grms per Lt.) solution of sodium hyposulphite and then rinsing with boiling water and sulphuring in the usual way.

Before vintaging the must is tested for its sugar, and if it shows less than 12 to 13o. B, sugar (as commercial glucose) is added before starting fermentation. This glucose is added at the rate of 4 Kg. per hogshead for each additional degree of alcohol required. A maximum of 10 Kg. per hogshead, equivalent to an additional 2½ per cent of alcohol, over and above that which would be produced by the natural sugar of the grape, is allowed by law.

It will be seen that apart from this addition of sugar to make up the corresponding deficiency in the must, this wine-making process is a purely natural one. The addition of glucose to low grade musts, allowed by the French law, which controls very jealously the purity and excellence of the French wines, is intended only to raise the alcoholic strength, by a natural process of fermentation and within certain specified limits, in order to improve the keeping qualities of these wines, whenever owing to the vicissitudes of the weather the natural formation of sugar in the grape has been incomplete. Therefore, the practice as regulated by law, cannot be considered as derogatory to the quality of genuineness any more than the process of disinfection and clarification which are carried out to protect the wine from alterations and diseases.

The grapes from which the Medocs are made are usually vintaged separately and the product is blended in the required proportions at the time of the second « soutirage » or devatting in March or April. This system ensures uniformity of type and the standardisation of the product from year to year, two qualities which are very essential from a commercial point of view in order to conquer a market and to retain it. The proportions used are

One-third Malbec and Merlot, and

Two-thirds Cabernet-Sauvignot and Petit Vertot.

Petit Vertot is but little employed and Cabernet-Sauvignot gives volume, while Malbec and Merlot give the characteristic softness to the wine, which, if prepared with Cabernet alone remains too crude for many palates.

White wines are also produced on a limited scale in the Medoc district, but they possess no particular qualities and keep badly. They are made from Semillon and Sauvignon blanc in varying proportions. Sulphurations of these wines is limited by law to the extent of 400 mg. of SO_2 per Lt. The chemical is applied in the liquid state by a special apparatus so as to regulate the dose, and 200 mg. is the quantity usually adopted. This instrument consists of a perforated iron tube, about 2 inches in diameter, closed at the bottom by a nail or conical plug and at

SULPHURING APPARATUS.

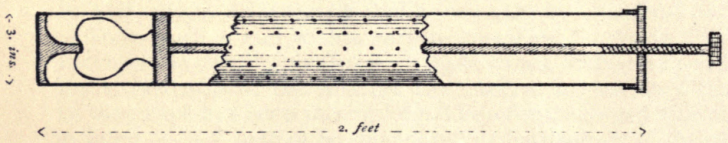


Fig. 2.

the top by a long screw. Special stout glass bottles, containing 25 c.c. of the liquefied gas, represent a dose which is equivalent to 200 mg. per Lt. to a hogshead cask. A bottle is put into the tube above mentioned and fixed in position by lowering the screw. The instrument is then introduced into the cask full of wine, through the bung hole. A gentle pressure of the screw perforates the bottle at the bottom by the nail pressing upon it and the liquid gas, which volatilises almost instantly, is immediately absorbed by the wine. (Fig. 2).

The White Wines of the Medoc generally show from 13 to 14 per cent of alcohol, but as above stated they are short-lived and do not keep well for more than three or four years.

Sauternes. — The Sauternes are sweet, white table wines with a characteristic bouquet and a raisin flavour, and contain 17 per cent of alcohol. Vintage is postponed until the rainy season sets in when the grapes attain the « pourri » state already referred to, and usually begins on the 15th of August and continues for one month. The pickers gather only the « pourried » grapes from the bunches, picking the berries by hand from each bunch, and therefore go round the vineyard several times until the whole of the crop is collected. The berries are collected in wooden baskets and poured into tubs carried on a long pole; these tubs are conveyed to the factory on large carts drawn by oxen. The grapes are first passed through a crusher and then pressed into a Vermorel press or in a hydraulic one. The marc is then removed from the press and passed through a sifter to retain any stray pieces of stalk. A second pressure of the marc gives a further yield of must, and this operation of removing the marc and pressing again is repeated a third time. In the best equipped « chateaux » the machinery is worked by electric power and hydraulic gauges show the pressure to which the marc is being subjected. This machinery is generally capable of developing a maximum pressure of 200 Kg. per sq. c.m.

The must, which generally shows from 20 to 25o B. is run into a « pit » on the floor of the press-rooms, and then pumped into hogshead casks. The casks are conveyed to a cellar and lightly plugged with a glass stopper, set inverted to avoid internal pressure, or by a bottle placed neck downwards, the object being principally to keep the air out of contact from the fermenting must. Fermentation is usually completed in eight weeks. The liquor is then transferred to heavily sulphured casks, and this heavy sulphuring of the casks is attended to with great care for every subsequent devatting or « soutirage » and generally four « soutirages » are made during the first year. The casks are always kept scrupulously full and but lightly plugged, but after the first fermentation the glass plugs are set properly.

The wines are highly sensible to climatic influences and swell in bad weather, even when fermentation has ceased com-

pletely, owing to the expansion of the gases in solution. If wooden plugs are used, these will, of course, become wet during the swelling, and, as they do not dry quickly, the occurrence may lead to acetification of the wine, hence glass plugs are always preferred.

During the second year the wines are kept in another cellar. « Soutirage » or devatting is now done at an interval of six months, that is only twice during the year. At this stage the wines are always clarified with gelatin, once or twice. The gelatin is usually added at the rate of 15 to 26 grammes per hogshead, as required, dissolved in a little wine or water, one month before the « soutirage ». In some « chateaux » white of egg is employed at the rate of six to eight whites per hogshead.

In the third year the wines are again shifted to a third cellar. The glass plugs are removed and the wines are properly bunged with wooden stoppers and set inclined so that the bungs may be continually under the wine. Two small holes are also practised at the head of each cask and plugged with wooden stoppers for any further surveillance of the wine, during the maturing process.

By the end of the third year the wines, which so far have been kept as original casks are mixed together in big « melangers » to form a vintage wine of a uniform type, which is immediately bottled and stored away. Thus this year the produce of 1917 is mixed and bottled to form the 1917 vintage. The bottling is often made in the « châteaux » itself, and then each bottle bears the chateau label, with the respective year of vintage, and a stamped cork to guarantee quality and origin.

The Sauternes may be put on the market immediately after bottling, but they are usually kept for from five to ten years or more, by which time they develop fully their best qualities. The cellars or « caves » in which the Sauternes are kept are built all on the same principle and are generally sunk in the ground or dug in the rock. They are about one hundred paces long and twenty broad, but always perfectly dark, and often high-roofed. In the best « chateaux » they are also provided with double doors, probably to avoid abrupt changes of temperature, and ventilation is secured by means of very small apertures in the vault. The temperature varies from 10 to 15o C. for the cellars in which the wines are kept in casks, and from 6 to 8o C. for those in which the wines are kept in bottles. For its good keeping, the older the wine, the lower should be the temperature.

Chateau bottling. — The vintages of the Medoc are divided into five classes, each of which comprises a number of the more renowned chateaux. Chateaux Lafite, Chateaux la Tour, Chateau Margoux and Chateau Haut Brion from the first class. The second class comprises 16 chateaux, the third 13 chateaux,

the fourth 11 chateaux and the fifth 17 chateaux. To the fifth class are also annexed a number of equally superior vintages which form together a « bourgeois » sub-class.

The Sauternes are likewise divided into two classes the first of which comprises ten chateaux and the second 11 chateaux; but Chateaux Yquem is often described as forming a « Grand 1re. Cru.» by itself owing to the superfine quality of its wine. However Chateau Lafont belonging to the first class is a close second and there is much rivalry between them to secure the primary of the whole Sauterne District, as I had occasion to note from personal experience.

An important feature of the vintage in the Gironde is « chateau-bottling ». This qualification is usually dignified by the inscription «mis en bouteille au chateau», with the year of the vintage, as well as by the chateau label and seal and a stamped cork. The practice of chateau bottling is claimed to have been initiated at Chateau Lafite, and possibly, simultaneously, at Chateau Yquem in 1846 and indeed some of the « Chateau bottled 1846 Lafite » was still on the market at Bordeaux a few years ago. However, the practice of chateau-bottling is reserved for vintages of exceptional quality only and is not followed from year to year; so that the inscription « mis en bouteille au chateau » does not only guarantee the purity and origin of the wine, but also its quality. Usually when the quality is not of the required standard, the wine is simply sold as red or white wine. There are therefore, many gaps in cheateau - bottling, due rather to a slackening of the practice caused by various circumstances and the fluctuations of the market rather than to the real existence of a continuous period of comparatively bad years.

If the wine is sold out of the chateau in March or April of the first year, or during the second year, should it be of sufficiently good quality, with a promise of improvement with age, it is often bottled at Bordeaux by the purchasers. In such cases the purchasers apply for permission from the chateau to lable it with the name of that chateau, however without the qualification of « chateau-bottled ». Wines which originated from various « chateaux » of the same « commune » are often labelled with the name of the « commune »; but the name of the « commune » is not a guarantee of the excellence of the wine, as the commune may include chateaux producing a first class wine and chateaux which produce only a wine of minor importance.

Wine keeping at Bordeaux. — The best wines vintaged in the Medoc and Sauterne districts are exported from Bordeaux mostly bottled. The finer vintages, generally bottled in the chateau, are conveyed there the third year, that is immediately after bottling as above mentioned, and therefore they receive all the treatment required in the cellar,at the hands of the grower. These bottled wines are simply laid up in a cool cellar and al-

lowed to age for at least ten years before they are shipped. However, the less successful vintages are usually brought to Bordeaux in March or April of the first year after vintage, immediately after the second « soutirage », and therefore receive there all subsequent treatment and are finally bottled by the exporter.

The treatment which the red wines receive at Bordeaux does not differ in principle from that which they receive in the chateau, but the casks employed at Bordeaux are usually made of chestnut instead of oak. In the first year two devattings or « soutirages » are made, namely, one in July or August and one in October or November. These, together with the two « soutirages » made in December or January and in March or April by the growers, make the usual four « soutirages » which are universally practised for all wines. The second year the wines are transported to another cellar and the casks are bunged and set inclined so as to wet the cork. « Soutirage » is now practised every six months and clarifying with white of egg, at the rate of six or eight whites for each butt, is made at this stage, three or four weeks before the time for devatting.

When three years old the wines are pumped into cement vats lined with glass, which are kept hermetically sealed. The capacity of these vats is about 130 hogsheads and the whole operation is practically equivalent to a mixing or blending together of the wines. During the same year two devattings are made from one cement vat to another and the wines are also filtered when necessary, by a Gasquet or a Simolton filter. In the first six months of the fourth year, the wines are bottled in black glass bottles, and transported to another store where they are allowed to age, and as a rule the wine is not placed on the market for retail trade before it is about 10 years old.

The white wines receive a somewhat different treatment at Bordeaux, but essentially the same usually received at the chateau. Two more « soutirages » are made during the first year always in fine weather, namely, one in July or August and one in October or November, the casks being kept lightly closed by the ordinary method of inverting the glass plugs. Extra « soutirages » are also made if the wines resume active fermentation at any time during this period. This is a very essential detail of the whole treatment, otherwise the excess of sugar present in the wine will soon disappear and the wine will lose one of its principal characteristics. Hence, as soon as it is ascertained that fermentation has set in, the wine is immediately devatted into a cask highly sulphured in order to stop the process at once. In the follwing year the casks are shifted into a second cellar and properly bunged with glass plugs. They are also clarified with white of egg, once or twice as may be necessary, but « soutirage » is renewed on the same lines whenever the wine shows again signs of fermentation. This usually happens twice or three times during the year, but sometimes more; indeed every change of the

weather affects the wine,and the casks are heavily sulphured for each devatting, particular value being given to this heavy sulphuring of the casks. This treatment is continued throughout the whole of the third year, but naturally becomes less intense, the object being to check the transformation of the little sugar left unfermented and to keep the wines slightly sweet. In the fourth year the wines are transported to a third cellar, properly bunged with wood and sealed, and then set inclined so as to keep the wooden plug always wet. In the following year the wine is bottled in green glass bottles. Blending for both red and white wines is usually made just before bottling, but may be made at any time before. At Bordeaux the casks for white wines are made of chestnut wood just the same as for red wines, and all new wood is very effectively treated with hyposulphite of soda, as at the chateaux.

Reference should be made here to the type of cellars usually adopted at Bordeaux. These are best illustrated by the caves and depots of Messrs. E. Eschenauer, of No. 42 Ave. de Boutant, who is one of the biggest shippers of the Bordeaux wines and to whom I am also indebted for most of the information detailed about the methods of keeping wines at Bordeaux. The cellars are constructed at the level of the street or slightly below it, but are never deeply sunk in the ground as in some chateaux of the Sauterne district. They are provided with thick walls and a vaulted roof which gives them the apppearance of a tunnel, and the entrance is guarded with a double door, while there are no windows and all light is scrupulously excluded. The temperature in these cellars is remarkably uniform and ranges only from 10 to 15o C, throughout the whole year, this uniformity of temperature being the principal requisite in the keeping of wines both to insure a slow maturing process and to develop the bouquet to the best advantage.

THE TABLE-WINES OF SPAIN.

Spain possesses some fine wine-growing regions, but none of them, with the exception of Jerez and Malaga, have acquired much fame. This is probably due to the fact that most of the Spanish table-wines go flat by the fourth or fifth year; but they are also harsh to the taste, particularly the red wines, on account of the abundant tannin they contain. Besides these natural defects of the wines themselves, there is the drawback of an objectionable practice everywhere prevalent, except at Tarragona, consisting in the blending together of various wines in order to produce wines of a given type, more or less artificial in character. Such blended wines are placed on the market usually under

the name of the district which has produced them, but this name although it practically guarantees the origin of the product, gives no assurance as to its genuineness and constitution.

The best known table-wines of Spain may be classified as follows :-

1. *The Panadés wines.* — This class of wines may well stand first among the table-wines of Spain, and includes wines of both red and white types. The red Panadés wines have an established reputation, which they fully deserve, but the white Panadés are also wines of superior quality, although far less known than the red wines.

The red Panadés are light, soft wines of a light claret colour, with a good « bouquet » and a pleasant flavour and contain from 9 to 12% of alcohol. They are not prepared from any special assortment of grapes, but from the varied produce of a region extending along the eastern coast of the Peninsula, south of Barcelona, as far as S. Vincente de Calders, and expanding westward to the banks of the river Foix. Some of these wines are distinguished as special vintages, among which the best known are Castel Cunit, Castel Romay and Torre Blanca. There is also a very superior type of red Panadés wine known as *Rosado Panadés* which, unlike other Panadés wines, is prepared from Morastel grapes, without the admixture of other grapes.

2. *The Priorato wines.* — This class is next in importance to the Panadés wines. The Priorato wines are strong, crude wines, produced mostly from Garnacha (Grenache) grapes and, when young, are of a deep colour which they partly throw down as they grow old. The best known of the Priorato wines is « Ransio » which, as a rule has 17% of alcohol and has a peculiar flavour, the « ransio taste ». The region which grows this wine extends south of the Panadés, west of Vendrell, including Reus and Marsa Falset. There are also white Priorato wines, but they are of minor importance.

3. *The Rioja wines.* — The Rioja wines find much favour in Spain, they are mostly white wines and are all produced by blending different wines until the desired type is obtained. Their alcoholic strength is 15 or 16%, and they are produced in a vast district South of San Sebastian, including Pamplona, Aoiz, Egea, Cortes, Torrecilla de Camer and San Domingo de la Calda. The most popular of the Rioja wines is Diamante, which is a light white wine of superior quality, and is considered as the king of the table wines in the North of Spain. Red wines are also produced in the Rioja district but they are mainly atypical and have no importance.

4. *The Mancha wines.* — The Mancha wines, of which there are numerous types, are grown in a region including Toledo and Ciudad Real, and extending eastward as far as San Clemente and Alcaraz.

5. *The Carinena Wines.* — The Carinena wines resemble very closely the Rioja wines and are grown in a region extending from Carinena to Saragoza in the North, and Pina in the East.

6. *The Utiel wines.* — The Utiel wines are light wines grown in a small district around Utiel. They approach somewhat the Panadés wines and have from 10 to 12% of alcohol. There are both red and white wines of this class, as well as of the two preceding classes.

7. *The Alicante wines.* — The Alicante wines contain from 15 to 16% of alcohol, and are grown in a district around Alicante reaching Villena in the North and Albaterra Catral in the South. The red Alicante is a good table wine, and the white Alicante, although much less known, is by no means an inferior wine.

8. *The Tarragona wines.* — The Tarragona wines comprise three distinct types, viz : «Tarragona Port», «Tarragona Campo » and « Tarragona white ». « Tarragona port » is a fortified wine, and will be referred to later. « Tarragona campo » and « Tarragona white » are two table wines with 14 to 16 and 10 to 12% of alcohol respectively. « Tarragona campo » is a heavy red wine rarely placed on the market as such, and is chiefly used in the manufacture of « Tarragona port ». « Tarragona white » has a delicate flavour and is justly appreciated. It keeps well for long periods and improves with age, and is exported as a superior and valuable table-wine.

The methods of preparing these table-wines are practically the same throughout the whole of Spain. The red wines are usually bottled during the course of the first year and the white wines during the course of the second year after vintage. The wines are therefore never allowed to mature properly, but are despatched before they are given a chance to acquire the mellowness and fragrance which are so remarkable in the French wines and which can be developed only by long years of keeping. Moreover the wines in Spain are almost everywhere kept in cement cuves, as against the prevailing practice in France, where the wine is kept in wood, or rather in casks of small size. To this practice may, possibly, be ascribed the defect above referred to, that the table-wines of Spain go flat by the fourth or fifth year; and this view is supported by the fact that the « Tarragona campo » and the « Tarragona white », which are kept in small casks like the French wines, do not show these signs of deterioration, but continue to improve by keeping, although like all the wines mentioned above they are not made from definite selections of grapes.

The process of vinification in Spain may be briefly summarised as follows : the grapes are gathered when perfectly ripe and are pressed in Vermorel or hydraulic presses. The red wines are allowed to ferment on the skins, for four or five days,

in open vats provided with one or more submerged heads. They are devatted into cement cuves and left for three months, after which period they are devatted again and, if sufficiently clear, they are blended and bottled without any further treatment. If the wines are not clear enough they are allowed to rest for about three months more, during which time they are clarified once or twice with gelatin or with white of egg.

The white wines undergo a somewhat different treatment. The must is allowed to flow from the presses into circular pits on the floor and is then pumped into big vats supported on pillars four or five meters high, on the first floor. The must is heavily sulphured on the way to these vats by an apparatus known as « Systema de Vinerias Barbet ». In this apparatus the sulphur dioxide is supplied from iron cylinders capable of holding from fifty to one hundred litres of liquid gas. This treatment disinfects the must very thoroughly and checks fermentation completely, but does not kill the wine-ferment. The sulphured must is allowed to stand for two days, during which time it throws down abundant deposits. The liquid is then pumped into a neighbouring vat and allowed to fall, through a hole in the bottom of this vat, into a « reservoir » on the ground floor. From this it is pumped again into the vat and allowed to fall again in the same manner, this operation being continued until the must loses most of its sulphur dioxide. It is then allowed to ferment. Fermentation proceeds very slowly at first, but soon becomes well pronounced and then subsides again, but does not stop altogether. On the fifteenth day the must still in fermentation, is pumped into another vat in which it is allowed to remain for three months, or until the fermentation has ceased completely. On account of the presence of the sulphur dioxide in solution, fermentation never becomes tumultuous, but developes and proceeds very slowly and maintains throughout a healthy character. At the close of the three months the young wine is pumped into cement cuves lined with glass, and left to mature for one year. However, abundant deposits are often formed in these cuves which of course necessitates one or two devattings during this period as soon as it is noticed that an abundant deposit has accumulated. The wines are usually blended and bottled after the first year and are generally consumed within the first three years, when they have not yet acquired their flat taste.

Considerable difficulty is often experienced on account of the over-heating of the must during fermentation. So far, however, this difficulty has not been definitely overcome in Spain where the apparatus adopted in Algeria is not yet in use and the only remedies resorted to are — for white wines, the heavy sulphuration referred to above and — for the red wines, the immediate pumping of the overheated fermenting must into

another vat. Another practice which is gaining ground consists in keeping the sulphured must until November, when the temperature goes down to 20 or 21 degrees C. and then to aerate it so as to remove the excess of sulphur dioxide and induce fermentation in cooler weather. The results obtained by this method are tolerably good, but the practice is not looked upon with much favour for no apparent reason, except, perhaps, the exigencies of the market.

Spanish table-wines are exported in considerable quantities to Norway, Sweden, Denmark, Germany and Russia, and during the late war, Alicante wines have displaced Sicilian wines from many islands in the Mediterrenean. All table-wines exported from Spain are pasteurized before shipping, at a temperature varying from 60 to 70 degrees C. according to the percentage of alcohol they contain. Numerous types of apparatus are employed including machines with coiled tubes, machines with tubular bundles and machines with helicoidal compartments.

As already mentioned, with the exception of « Tarragona campo » and « Tarragona white », which are kept in casks, most of the Spanish table-wines are kept in caves. These caves are mere dug-outs in the compact clayey soil which is often twenty meters deep. In these caves the wine cuves are built of bricks and armed cement in rows of ten or fifteen. They have a cylindrical shape, with a side opening for cleaning and a wide mouth at the top. The method of closing the latter aperture consists in applying a cover, made also of cement, which sinks into a circular canal generally filled with water and sometimes with oil, and the stored wine is thus completely shut out of contact with air. This method of closing the cuves is known as the« hydraulic seal ».

The capacity of the cuves is about 600 Hl. and the temperature of the caves varies from a minimum of fifteen to a maximum of twentyfive degrees C., but is usually almost stationary at from 18o. to 20o. C.

Before filling with wine, the new cuves are subjected to a very simple treatment to remove residues of cement which may impart a bad flavour to the wine. A thorough brushing is applied with a 20% solution of tartaric acid and the cuve is allowed to dry for 48 hours. It is then rinsed with water and again allowed to dry for another 48 hours. This operation is repeated in the same manner and then the new cuve is allowed to dry perfectly for two or three days before it is filled with wine.

THE TABLE-WINES OF PORTUGAL.

In Portugal the table-wine industry is entirely in the hands of big companies and there is considerable export trade with Brazil and other parts of South America. These companies are well organized associations often resulting from the amalgamation of several smaller companies, each of which retains its individuality but is controlled by the managing committee of the association to which it belongs. This concerted action safeguards the interest of the several companies, and at the same time is all to the advantage of the export trade as a whole.

Very few of these companies own vineyards of any importance, and indeed, in many parts of Portugal, the vineyards are parcelled out into small allotments among the farmers. As a rule the small farmers grow specialised vineyards for the use of one or other of these small companies with whom they are usually on very good terms. The small companies produce the particular type of wine in which they specialise, and the disposal and export of their produce is regulated by the big associations to which they are affiliated.

Portugal produces many first class «vins de liqueurs» some of which enjoy a world-wide reputaion, such as Ports, Madeira, White Porto de Sud, Muscatel, Beneficiado and Abafado. These wines shall be considered along with other fortified wines under a separate heading. On the other hand, Portugal does not produce any table-wines which can be considered as really great wines, although there are several types which have attained a high standard of quality such as the Colares wines, red and white, Bucellas and Grandjo. In addition to these, Portugal produces also certain crude wines, known as Vinhos Verdes, which are specially appreciated by the Portuguese themselves, for their refreshing qualities. There are also certain types of wine which are principally intended for exportation to Brazil, and are more or less artificial blends, closely resembling the Spanish wines.

One of the biggest wine concerns in the South of Portugal is the « Companya dos vinhos ed azeites du Portugal » which controls most of the table wines of Estremadura, and in particular the Colares wines, as well as the celebrated liqueur wines, Madeira, red and white Porto de Sud and Muscatel Setubal This Company keeps several factories of which the most important is « la Maison de Viuva Gomez » at Colares, a few miles from Cintra, for dealing with Colares wines. Other important factories belonging to this Company are « Maison Madeira » in the island of Madeira, « Maison Setubal » at Setubal on the left bank of the Tagus, and « Villa Pereira » at Poço de Bispo, near Lisbon, where there is the central depôt of the Company.

Villa Pereira. — Villa Pereira may be considered as the headquarters of the « Companya dos vinhos ed azeites du Portugal », and to this place most of the wines manufactured or accumulated by the Company at Colares, Setubal and Madeira are conveyed and prepared for export. In this place the Company keeps also an analytical and research laboratory, as well as a fairly equipped distillery.

The cellars are built in two rows with an avenue between them, and the office and the research laboratory occupy a two storey building close to the main gate of the factory. There is also a residence for the Manager on the right side of the wooded grounds surrounding the factory. All the cellars at Villa Pereira are built on the same plan. Their floor is at the level of the avenue and they are about 50 meters long and from 10 to 15 wide, with a high roof. Each cellar has close to the entrance a small cistern or pit, dug in the ground and capable of holding about 600 or 700 litres of wine. These cisterns are made of cement, and each one is provided with a pump, worked by steam power from a central station. A groove runs all round the pavement of the cellar for drainage purposes, and a small window at the back of the cellar is all that is allowed for light and ventilation. In each cellar there are 20 or 22 vats or large casks, 10 or 11 on each side and two big mixing vats at one end, all of which are supported on wooden beams at a height of 80 c.m. from the ground, and are connected with the pump at the pits close to the entrance by means of tinned iron pipes. These pipes in two or three cellars have a diameter of from 10 to 15 c.m. and are divided longitudinally by parallel partitions through which the wine may be made to circulate in contact with a stream of warm water, so that if necessary the wine can be pasteurized. This apparatus is of the parallel bundles type and has been devised expressly to suit the methods of treating wines as adopted by the Company. The cellars are kept always very clean, and are whitewashed almost every month.

In addition to the cellars described above, which form the main block of the building at Villa Pereira and are usually reserved for the storage of fortified wines and the « Aquas Ardentes » or wine spirits, there is also a small cave dug in the rock beneath the ground level to which access is had by means of a ramp. This cave is reserved for the Colares wines and consists of a narrow corridor cut in the rock without any regularity or symmetry, and having small cement cisterns each capable of holding from 25 to 35 Hectolitres of wine.

The Colares wines which are forwarded to Villa Pereira are usually intended for export; but wines showing signs of deterioration or disease are likewise conveyed to this place for treatment or pasteurization. Immediately on arrival at the factory the casks are emptied into the cement pits close to the en-

trance of the cellars and the wines are pumped to the mixing vats, where they are blended as may be necessary and brought to the required standard. The blended wines are then left in the mixing vats for a month or more, during which time they throw down some deposit. Afterwards, if sufficiently clear, they are pumped to the cave or bottled for export.

The Colares wines are sometimes affected by turbidity, which does not appear to be pathological in origin, but is very persistent and does not yield easily to treatment with gelatin. In this case clarification is effected by means of a Spanish clay, called Barro de Hyspana. The material is cheap but the operation is tedious and involves a considerable amount of labour. The clay is kneaded in the wine by hand in small open vats and is then allowed to settle for four days. One great advantage claimed, and warmly insisted upon, for the use of Barro de Hyspana is that this clay leaves the composition of the wine unaltered.

The temperature at which pasteurization is effected for diseased wines as well as for sound wines intended for exportation to South America, is 60o C. This temperature does not kill the wine ferment in the Colares wines which contain 10% of alcohol, but it destroys the dangerous micro-organisms, and therefore stops all pathological processes which may be going on in the wine. The Colares wines can thus improve by keeping after pasteurization, and diseased wines which have been pasteurized often regain the qualities of sound wines.

Another interesting operation at Villa Pereira is the charring of the inside of new casks with sulphuric acid (one part of acid to two parts of water) as practised in Italy. The casks are also steamed after charring, and all the wood employed in the factory for the making of vats, casks and plugs is chestnut wood imported from Italy or Sicily or, in its absence, chestnut wood of local growth.

Viuva de Gomez. — Viuva de Gomez is the most important factory owned by the «Companya dos vinhos ed azeites du Portugal» and under its present manager, Mr. H. Barros, it has been largely extended by the addition of several stores and of spacious fermenting vaults. Annexed to it there are three smaller auxiliary factories, within a short distance of the main building and until lately, most of the red and white Colares wines vintaged by the Company used to be prepared in these subsidiary factories, and were afterwards transferred to Viuva de Gomez for maturing and storing.

The cellars at Viuva de Gomez are built on the same plan as at Villa Pereira, but they are much larger, being from 50 m. to 60 m. long and about one-third as broad. One of these cellars recently constructed is particularly large and has been devised to meet the increased demand of these wines. These stores are

kept scrupulously clean and are white-washed periodically as at Villa Pereira, and, moreover, during the hottest period of summer, the floor is frequently sprinkled with water to maintain a cool temperature.

The cellars of Viuva de Gomez contain each 6 or 8 erect vats on one side and 14 or 16 casks on the other. The vats are often of large size usually $3\frac{1}{2}$ m. high and $2\frac{1}{2}$ m. at the base, and there are a few which are $4\frac{1}{2}$ m. high and 3 m. at the base. These vats are supported on three pieces of masonry, two of which are semilunar and converge on the middle one in such a way, however, as to allow space enough between them for easy cleaning. The casks are supported on wooden beams as at Villa Pereira. There is besides, a store set apart for ageing small quantities of wine and containing 14 large casks on each side.

The fermenting vault is a large square room, isolated from the rest of the building, and contains two powerful presses each of which is fixed in a square cement basin or « lagar ». These « lagars » which have a square shape about 3 m. wide and 120 c. m. deep, are not meant for the fermentation of the must which is removed immediately after pressing, being made to flow out into casks through a wash-out at the bottom. Similar cement lagars for the pressing of the grapes, either by the feet or by beating with heavy rammers, are in general use in many parts of Portugal. These lagars, if not properly conditioned before use, are liable, to impart a peculiar cement taste to the wine, should the must be left for even a short time in contact with the newly cemented walls. In the south of Portugal this inconvenience is removed by rinsing the cement covered portions of the lagar with a solution of caustic potash and then washing repeatedly with fresh water before use.

The process of manufacture of the Colares wines at Viuva de Gomez is the same for both the red and white wines. The red wine is made from a local variety of grapes called « Ramisco, Casta regional de Colares » and the white wine from « Malvasia gaieiro » better known in Portugal as « Fernao Pires ».

There are two vintages each year, the first of which is made on the first of August and the second on the 7th. of September, to allow time for the late grapes to attain maturity. The grapes are collected in wicker baskets and conveyed to large, oval wooden trays, which are carried on carts to the factory. These trays are emptied into a crusher and shifter combined and the squashed grapes are thrown into the lagars, where they are further crushed by the feet or with wooden rammers and finally passed through the press. The liquid is conveyed at once as above mentioned, through a canal in the bottom of the lagar into small open casks, in which it is subjected to fermentation. The red wine is, of course, fermented on the skins.

After thirtysix hours the fermenting juice is removed from the casks to the big erect vats in the cellars, where it continues to ferment slowly, and scarcely perceptibly, for a long time, during which the bungs are set very lightly, so as to permit the escape of the gas. After one or two months, that is, when it is ascertained that fermentation has ceased altogether, the vats are bunged properly and left to themselves until December, when the first devatting is made. The wines are usually kept for two years in wood, before bottling, and during this time they are devatted three times each year, namely, in December, April and August. In the third year they are bottled and the operation is most carefully performed, the bottles being thoroughly cleaned and dried, and immediatelly before bottling they are rinsed with a mixture of equal parts of wine and of alcohol at 30%.

The marc left in the fermentation casks is not pressed to remove the juice which it may still hold, but is conveyed to one of the subsidiary factories, where it is allowed to remain for about one month to complete fermentation, and a wine, extremely rich in colouring material is thus obtained, which is made use of to correct the deficiency of colour of wine of the same type. The « vin de seconde serre » is sold throughout Portugal to make a refreshening drink with sugar and water, known as « aqua-pé ». The skins are dried and used for feeding pigs.

Rio-Frio. — The extensive vineyards at Rio-Frio, Valdera, to which special reference has already been made in connection with viticulture in Portugal, are the private property of Mr. Antonio dos Santos Jorge, but most of the wines vintaged in this place, as well as the large quantities of alcohol distilled, are dealt with by the « Companya dos vinhos ed azeites du Portugal ». The distillery is the principal concern of the establishment and its average annual production in wine-spirits, 30o Cartier, is calculated at 150,000 Lts. A table-wine called « Vinho liso », of which there is both a red and white type, is also produced on a large scale, both for export and for local consumption; besides small quantities of two white, sweet wines, known as Abafado and Beneficiado, which shall be considered along with other sweet wines.

The factory consists of three blocks of buildings, disposed at right angles to one another, and forming a spacious enclosure between them, open towards the North. The central or main portion of the factory is reserved for storing in wood the red « vinho liso » and the sweet wines Abafado and Beneficiado as well as the « aquas ardentes » or wine-spirits, the « aqua-pé » and the other wine products. The two lateral wings of the buildings contain the lagars, the fermenting vats, the distilling apparatus, the work-shops and some cuves for the white « vinho-liso ».

The eastern wing is made up of seven or eight stores. Each store is about 80 m. long and half as wide with small windows at the back and a light ceiling of earthen tiles supported on a wooden frame-work. Two of these stores contain the lagars for vintaging the white wines, and the others are used as general stores or work-shops. Across each lagar there is an iron beam coated with cement, from which the men beat the grapes with heavy wooden rammers before the skins are finally removed. Portable crushers are also mounted on the partition walls of the lagars and a common duct, made of cement, carries the must from the lagars to a small reservoir from which it flows through tinned iron tubes to the fermenting cisterns or vats in the western wing.

The western wing is made up of 19 or 20 stores, three of which contain the power-station provided with two powerful electric motors, along with the boilers, and a huge Savars distilling apparatus. Each store is about 80 m. long and 15 m. broad and is built on the same plan as the stores of the eastern wing. In several of these stores there are 24 vats dug in the ground, 12 on each side of the store with a narrow sunken corridor between them. These vats have a capacity of 50,000 litres each and are coated with glass and provided with a square lid or cover at the top and an opening at the bottom, on the side of the corridor. In several of these stores or cellars there is also a row of casks, each of about 700 litres capacity, containing wine-spirits for the manufacture of the sweet wines Abafado and Beneficiado.

The process of the manufacture of the white « vinho liso » is somewhat different from that of the Colares wines. The grapes are gathered in wicker baskets and transported to the factory in large wooden trays on carts. On arrival at the factory the fruit is thrown into the crushers, from which it falls directly into the lagars, where men continue the crushing with their feet, by jumping about the lagars, and then finish off by beating with wooden rammers. The must is allowed to flow through tinned iron tubes from the lagars to the fermenting vats or cisterns dug in the ground, mentioned above, and is allowed to ferment for thirty or forty days, the fermenting must being frequently pumped from and into the same cistern for aeration.

The process of fermentation is very active during the first days and then slowly subsides. After 30 or 40 days the fermented must is transferred to another vat in the same store and left until December, when the first devatting takes place. Other devattings are made in April and August and the young wine is then allowed to mature for some time in one of the cement cuves.

The must is heavily sulphured before fermentation is started and the same operation is repeated on the young wine before storing it in the cuves to mature. This sulphuring is made

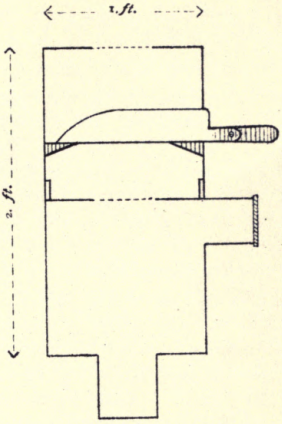
by means of an interesting device known as «Pietro Frao's apparatus of the Compagnia Vinicola Centrale of Italy», which consists of two tinned iron drums, placed one over the other, and communicating through a hole protected by a sieve. The lower drum has a tube at the side and another tube at the bottom, through which the must or wine which is being sulphured is allowed to flow. The upper drum is covered with a sieve at the top and has a large opening at the side, through which a palette with burning sulphur is introduced. The flowing wine or must draws the gas through the sieve and immediately absorbs it, producing a partial vacuum which is at once replaced by more gas from the sulphur burning in the palette. This method of sulphuration is believed to be very reliable and at the same time its application is most easy, which accounts, perhaps, for its having been extensively adopted throughout the whole of the South of Portugal, while the apparatus is quite easy to handle, being only about 70 cm. in height. (Fig. 3).

The skins left in the lagars still contain considerable quantities of sugar and therefore are fermented separately for distillation. They are transported in cannisters from the lagars to one of the glass-lined cement cuves, above mentioned, until it is about two-thirds full. Tap-water is then run in to float the skins, and when fermentation subsides the liquid is transferred to the still and distilled at once. The residue of the distillation contains still from 7 to 8 per cent, of alcohol and is therefore pressed and set aside to mature as « aqua-pé ». The distilling installation at Rio-Frio can deal with 45,000 litres of these secondary wines per day.

The manufacture of the red «vinho liso» is conducted on the same lines as the white « vinho liso » but all the work of the vintage, etc. is made by machinery and always on established days, namely, the 7th and 8th of September; the various operations being conducted in the main building of the factory, two stores of which are built for the purpose. These two stores contain a number of lagars along the walls and large glass-lined cement vats dug in the ground in the centre of the stores. The grapes are emptied from the large wooden trays in which they are brought to the factory, into a shifter and crusher combined, worked by steam power, and the must is collected into a reservoir from which it is pumped into the lagars. Fermentation is allowed to proceed for thirtysix hours and the supernatant liquid is then drawn off the marc and transferred to one of the cement vats and the « vin de presse » produced by pressing the marc, is put apart and reserved for blending to impart more colour if necessary. All subsequent treatment for maturing both the red and white wines is practically the same as that followed at Viuva de Gomez. The temperature of the fermenting must in both red and white wines varies between 29 and 31 degrees C.

PIETRO FRAO's APPARATUS

FOR THE SULPHURATION OF MUSTS AND WINES.



SECTION.

Fig. 3.

THE NORTH OF PORTUGAL.

The North of Portugal is renowned for its port-wines, which will be referred to in detail later on; but table-wines of a superior quality are likewise produced in that region and are the object of a thriving industry. Here, as in Estremadura, the wine industry is entirely in the hands of large companies and all the wine produced is either prepared by these companies in their own factories or is bought by them for maturing or blending, within the first three months after vintage. One of the most important companies in the North of Portugal dealing in table-wines in the «Real companya Vinicola du Nord du Portugal ». I had occasion to visit the factory of this company at Villa Nova de Gaya through the courtesy of Mr. Miguel de Souza Guedes, a well known port-wine manufacturer and exporter. The factory of this company is by far the largest at Villa Nova de Gaya and occupies a number of terraced platforms covering several hectares of land. The factory has spacious avenues, and consists of three distinct sections, namely, the cellars, the workshops and the offices. The stores or cellars are large and airy, but, owing to the irregularity of the ground, they rise one above the other on different levels and are for the most part too much exposed to the rays of the sun. The position of the factory, however, presents many advantages for the convenience of traffic and the handling of the produce and these very probably were the factors which determined its selection.

The company has accommodation for storing in wood a very large quantity of wines and in some cellars the casks are piled into pyramids for want of space, while in one of the largest stores at the level of the main road there are twentyfive mixing vats each of 150 pipes capacity. Besides this facility for storage the company has also put to use an abandoned railway tunnel, for storing Champagne, which it produces on a small scale.

Not less interesting than the cellars are the workshops of the company, where the wine casks and vats are made. These workshops are the largest of their kind which I have seen either in Portugal or elsewhere, and all the work is conducted by steam power. The wood, generally oak or chestnut, is imported in logs and is worked there as required. During the last few years owing to the difficulty of obtaining supplies of oak or chestnut from European ports Freio wood has been imported from Brazil and is replacing the European material. The mixing vats are made of mahogany, instead of oak or Freio or chestnut, and it is believed that this wood resists much better and much longer than any other wood, especially when the vats are used for storing wine for long periods.

All new casks and vats are treated before use with a 10% solution of caustic soda and then with a 10% solution of ammo-

nia. They are afterwards washed with pure water and finally steamed.

Several types of wine are manufactured by the Company but the most important of these are:

Grandjo, a light white wine;
Evel, a light red wine;
Ermida, a rather strong white wine, and
Famiglia, a strong red wine

as well as « Champagne » and considerable quantities of Port-wines.

The light wines Grandjo and Evel contain from 10 to 11 per cent of alcohol and are mostly consumed locally, while the stronger wines Ermida and Famiglia contain from 13 to 14 per cent alcohol and are generally exported to Brazil. These wines are prepared up the river in various localities by the growers and are then conveyed to Villa Gaya and blended together to produce the desired type. Grandjo is an imitation of the Sauterne wines and is prepared from over-ripe grapes almost in the raisin stage, while Evel is prepared from a varying assortment of red grapes which are fermented out of contact with air, in closed vats provided with a water valve.

The champagne manufactured by the company is of a good quality, but it is prepared from one kind of grapes only, namely, Pinot Noir, while genuine champagne is made from both Pinot noir and Chardonnay or Pinot Blanc. The process is a close imitation of the champagne method. The grapes are pressed in hydraulic presses, from which the skins are extracted perfectly dry, and the must is immediately bottled and stored, a manometer being inserted in some of the bottles to gauge the pressure. When the pressure reaches 9 or 10 atmospheres the cork is dexterously changed and all the deposit, gathered in the neck by overturning the bottle, is also removed with it. New corks are then put in and permanently bound by wire, and the bottles are again stored away in a recumbent position.

The process of making champagne is very simple and requires only some dexterity in the removal of the corks and of the deposits, but even by using the same grapes employed in the Champagne and by the addition of perfumed syrups, very different results have been obtained by most producers. The fault does not appear to rest with the grapes to the same extent as it is in the case of other wines, but with the temperature of the cellar in which the must is fermented or rather its fermentation is completed. The best temperature for this purpose is 15o C.

The wines shipped by the company to Brazil and other parts of South America, as already stated, are Ermida and Famiglia which contain 13 to 14 per cent of alcohol. These

wines before bottling are pasteurized at a temperature of 60o C. by an apparatus of the « coiled tubes » system constructed by the Cie. Raul Pictet, 28 Rue de Grammont, Paris.

Vinhos Verdes. — A type of wine which is frequently met with on the Douro and which is indeed peculiar to the place, is the so called Vinho Verde. Both red and white wines of this type, are prepared and they are so called because they are harsh to the taste and produce in the mouth the sensation of unripe fruit. Their manufacture and the manipulations to which they are subjected do not differ from those of the ordinary table-wines except in so far that they are fermented during the latter half of August, when the temperature usually stands between 28 and 31 degrees C. These wines form tolerable table-wines when well prepared, and they are very often bottled in terra-cotta bulbs. The red wine has a very deep colour and this characteristic together with its acidity makes it a very good wine for blending purposes.

There is no farm on the Lower Douro where a small quantity of Vinho Verde is not vintaged every year, and the peculiarity of these wines to which they owe their popularity is the curious way in which they relieve thirst when drunk in small quantities. The grapes employed in the preparation of these wines are: Izal for the red wine and Fernao Pirez for the white wine. They are the produce of a large district in which no other wine is made, extending from the River Minho, in the North, to the South as far as Aveiro and their production does not extend further up the Douro than Regoa, where the Port-wine district begins.

THE TABLE-WINES OF ALGERIA.

Algeria produces some fine red and white table-wines, among which Royal Kebir, a red table-wine, and Imperial Kebir, a white table-wine, both prepared by Messrs. Lung Freres, have acquired a well merited reputation, but the bulk of the Algerian wines is usually sold out merely as Algerian wine, red or white without any special designation. They are however generally classed as « vins fins » or « vins ordinaires » according to their quality and the process of their manufacture. In addition to these types of table-wines there is also a « vin rosè », which is produced on a much larger scale in Tunisia, and is being greatly appreciated by « connoisseurs ».

Most of the wines produced iu Algeria are transferred to the caves of the town of Algiers, during October and November, where they are submitted to up-to-date methods of

storage and maturing, which deserve to be adopted or imitated by other wine-growing countries in warm latitudes. The wines are usually vintaged by the small proprietors who generally have no accommodation on their own lands for storage and ageing, and usually cannot command the necessary skill for the efficient treatment of the wines in order to obtain a finished product of superior quality. However they generally grow select varieties of vines and, by dealing with small quantities of wine at a time, they can better control the ill effects of the temperature on the fermenting musts, which in this country is the principal difficulty in the whole process of vinification. Large factories, planned on most modern lines, are now rising in various parts of Algeria, and the time is not distant when this thriving French colony will hold one of the foremost places among wine-producing countries, both as regards the quantity and the quality of its table-wines.

The caves of Algiers are remarkable for their size and number, as well as for their construction, being carved out of the rock almost at sea-level on the side of the cliff facing North just below the town. Over these stores runs the Boulevard Carnot which borders the town towards the sea, and forms a high-road along which moves all the traffic of the town towards Mustapha on the East and Bab el Oued on the West. Most of the caves represent very high vaulted tunnels, blinded at the inner end, and closed at their mouth by brick masonry and large windows having wooden shutters, which can be opened to admit light during work. The rock between adjoining vaults forms a partition which is rarely less than 3m. in thickness, and adjoining vaults belonging to the same concern are frequently connected together by means of spacious corridors which allow easy passage of large casks from one vault to another. The arrangement affords ample security against variations of temperature, which in these cellars is very uniform throughout the whole year, usually varying only from 17o to 20o C., and is highest in winter.

On reaching the caves, the red wines are classified as « vins fins » and « vins ordinaires » according to their body, bouquet and alcoholic strength, and are then stored away, the former in wooden casks of the capacity of 118 Hl. and the latter in glass-lined cement vats of 267 Hl. each. The white wines are not made the object of this classification, and are always kept in wood, but they are never stored in the same cellars along with red wines.

The cement vats for « vin ordinaires » are constructed of an oblong shape, in rows of double fours occupying the whole breadth of the cave from side to side, so that access can be had only by means of side corridors from the adjoining caves. Generally two such rows are built in a cellar, making in all sixteen cement vats or cuves.

The cellars where the manipulation of the wines takes place are divided into an upper floor and a ground floor by a partition ceiling which is always made of stone, and generally is not continuous throughout the whole length of the cellar. On the upper floor there is a number of erect vats of varying capacity in which the wines are blended, while on the ground floor there are the filters, pumps and other appliances. The young wines are conveyed from the small factories at Algiers to the caves as soon as fermentation is completed, that is from 40 to 60 days after vintage, and immediately on arrival they are pumped from the hogshead casks in which they are conveyed to Algiers to the melangers or mixing vats on the upper floor of the cellar, where they are also blended to produce the desired type of wine. They are then filtered through « Gasquet filters » and stored in wood or cement-vats according to their quality as above mentioned. The « Gasquet filters » are kept on the lower or ground floor and the height of the upper floor which is about 5 or 6 meters represents the pressure at which the wine is passed through the filters. The wine is made to pass successively through two filters, which are usually arranged in groups of four, so as to enable the manufacturer to deal at the same time with twice the quantity of wine which would pass through one filter, and in this manner the work proceeds more expeditiously and the undue accumulation of casks from fresh arrivals is thereby prevented. The operation of filtering begins early in November and continues until late in December, and may be considered as the first « soutirage » or devatting which the wines receive in the caves. The second devatting takes place in March or April of the following year, the third in July or August and the fourth in November or December. All the wines, whether fine or ordinary, red or white, receive the same treatment, and a month before each devatting they are clarified with gelatin, if necessary.

At each operation all the casks and vats are scrupulously cleaned and heavily sulphured for all types of wines, and liquid sulphur dioxide is also applied to the white wines at the rate of 2 grammes per Hl. in much the same way as practised for the white wines of the Medoc. Red wines which do not appear to be keeping well enough are treated with potassium metabisulphate at the rate of four grammes per Hl. The slow decomposition of this salt, which is simply thrown in as crystals into the vat before filling with wine, preserves the wine from deterioration by a steady supply of nascent SO_2.

Two devattings are made in the second year, and again in the third year, at intervals of six months, and at each devatting the same disinfecting operation above mentioned is repeated. This applies more particularly in the case of the « vins fins », because the « vins ordinaires » are usually dis-

posed of during the first year after vintage. At the end of the third year the wines are bottled — the red wines in very dark glass and the white wines in green glass.

The white wines are aerated before bottling, to remove the excess of sulphur dioxide by the simple process followed in Spain, but here the height from which the wines are allowed to flow is only about one meter and the operation is not repeated or continued for some time by pumping the wine back to the vat, as sulphuration is never practised so heavily as in Spain. The bottled wines keep indefinitely and are usually disposed of after ten years of storage, when they are supposed to be at their best.

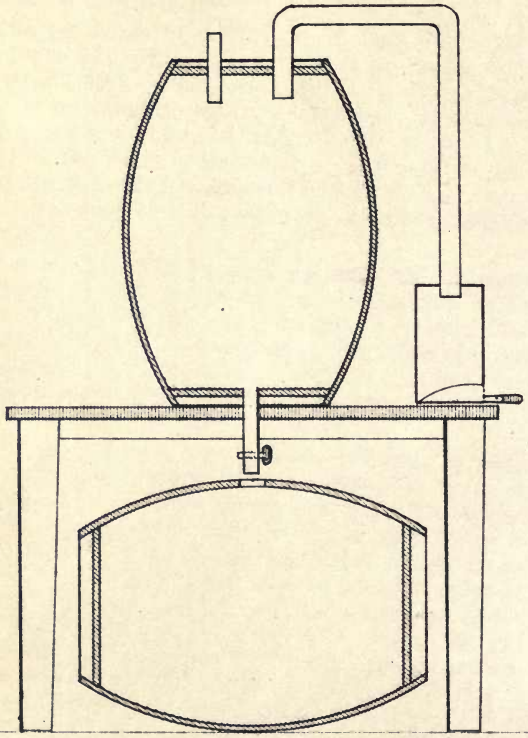
The red wines of Algeria show from 10 to 13 per cent of alcohol and the white wines, which are perfectly dry wines, show about 12%. The total acidity for both types of wine stands at 5 grammes per litre, expressed in terms of sulphuric acid, and the volatile acidity is 50 cg. per Lt. When the acidity of the must is less than 5 grammes per Lt., the addition of tartaric acid is allowed by law to make up for the deficiency provided that the addition is made before fermentation is started.

One of the most progressive wine-making establishments in Algeria, where the process of vinification in this country can be followed to the best advantage, is the Cave of Bem-Messous, in the district of Sahet. The wine vintaged annually in this place is estimated at 15,000 Hl. and most of it is stored and matured on the premises where there is accommodation for well over 30,000 Hl.

The factory is a high-roofed, rectangular building, with thick walls and without any windows, so as to reduce to a minimum the variations in temperature. There are four rows of 15 or 16 cuves, each cuve having a capacity of from 520 to 530 Hl. They are made of glass-lined armed cement and are meant to replace two older rows of cuves of the same capacity made of brickwork, which are still in use in the same building. These old cuves are cubical in shape but the new and more modern ones have a cylindrical shape, which imparts a greater resistance to internal pressure. All the machinery, which is worked by steam power, as well as the bottling department, occupy a site at the back of the building.

Vintage is begun on the 8th. of September and lasts from two to three weeks. The grapes are carried on carts to the factory and emptied into big «sifters and crushers combined» which remove the stalks and crush the grapes. (Compresseur de raisin No. 182 A. Blaquière, Beziers Herault). The crushed grapes fall into a large, open, cement vat, from which they are pumped, through pipes 4 in. in diameter, to the fermenting vats on the roof of the cave. These vats are of cu-

SULPHURING APPARATUS EMPLOYED AT JEREZ.



SECTION.

Fig. 5.

bical shape and are made of cement, their capacity is about 650 Hl. and they are protected from the direct rays of the sun by a broad shed.

The temperature at the time of vintage varies from 30 to 35 degrees C., and if Scirocco winds are blowing, it may even rise to 40o C. during the hotter hours of the day. The temperature of the must, freshly pressed, is usually cooler than that of the air by about 10o C. and therefore fermentation starts at about 25o C., rising gradually to 30 or 32 degrees C. When circumstances are favourable and Scirocco winds are not blowing, the temperature of the fermenting must remains stationary at 32 or 33 degrees C. but if the temperature of the air rises, that of the fermenting must also begins to rise and may attain 35, 38, 40 and even 42 degrees C. Fermentation is healthy only when the temperature of the fermenting must does not exceed 32o C., as at a higher temperature it becomes too violent and a portion of the sugar is left unfermented, with the result that the wine produced does not keep at all; it is poor in alcohol and therefore also in body as on the strength of the first depends the quantitiy of solid and colouring matter dissolved. Accordingly the temperature of the fermenting vats is carefully examined and registered every hour during the day, and, as soon as it shows a tendency to rise above 33o C., recourse is had to artificial refrigeration. As a result of this operation the temperature of the fermenting must is reduced by 10o C. and then the process of fermentation proceeds more regularly and healthily. Owing to the advantage of this refrigerating process the wine - growers in Algeria and other warm climates do not fear any longer an abnormal rise of temperature, which otherwise would ruin their vintage.

The apparatus employed for refrigerating musts are Pitolet's and Guillebound's Refrigerators. Both are made on the same principle, and consist of a series of tubes, about 2 meters long, disposed horizontally in a vertical plane over which there is a triangular tank. Water is allowed to trickle from the tank, while the wine is pumped through the tubes. The only objection to the use of this apparatus is that it involves a great deal of labour if the pumps are worked by hand, but the results obtained are highly satisfactory, and it is now being adopted everywhere in Algeria. The amount of water employed is generally about three times that of the wine cooled, so that 100 Hl. of wine require 300 Hl. of water. Where water is scarce, as it frequently happens in many places in Algeria, recuperation methods are employed, and the same water is used over again several times. These methods consist in allowing the water to trickle down, from a tank several meters high (8 or 10) down canvas sheets spread on an iron frame-work. The cavas is cut in various ways, generally in elongated conical bags or triangular flaps, but very often

it is simply spread on the railings. The evaporation, promoted by a dry and warm atmosphere, cools the water during its descent down the canvas.

Fermentation lasts about 4 days. When it subsides the supernatant liquid is run into cuves and the marc is pressed at a pressure of 150 Kg. per sq. cm. The two liquids are then mixed and allowed to settle for some days, after which they are devatted to remove the deposits which are generally very abundant. The cuves are heavily sulphured before filling with wine.

At Bem-Messous the new wine is devatted several times during the first year and not four times only as it is the practice in the caves of Algier. This devatting is done whenever there is a menace of excessively hot weather and the object is to separate the wine from its lees, which show a tendency to rise. This treatment, while safeguarding the wines from dangerous secondary fermentations, serves also the purpose of a highly efficient and a very elegant method of fining. In the second and third year the wines are not devatted so frequently.

The temperature of the Caves of Bem-Messous, and indeed of most wine factories in Algeria, varies from 15 to 25 degrees C.; it is therefore much higher than that of the caves of Algeries, and this, perhaps, explains the necessity of the frequent devattings made.

THE TABLE-WINES OF TUNISIA.

The table- wines of Tunisia are classed as « vins de coteaux » and « vins de plain » and there are red and white types of either kind; but no importance is attached to this distinction, and the factors which establish the quality of a wine are its body and its alcoholic strength. The «vins de coteaux » are decidedly superior to the « vins de plain » having more mellowness and a finer « bouquet ». Besides these red and white table-wines there is also a « vin rosee » which is now being produced on a large scale. Moreover, there are numerous types of « mistele » wines of inferior quality having little commercial importance.

The cepages from which these wines are produced are:

For the red wines — Petit-Bouschet, Alicante-Bouschet, Alicante, Carignan, Mourvedre, and Cuisaut.

For the white wines — Clairette, Beldi (an indigenous cepage) and Ugni Blanc.

The grapes ripen in the order in which the names of the cepages are given, and therefore, especially when the produce of large vineyards is dealt with, it is often expedient to fer-

ment the crop of each cepage separately and then to blend the wines produced in order to obtain the desired type. There is however, no definite rule for the blending of these wines which is conducted empirically by « gout », but the proportions usually employed for the red wines are two-thirds Carignan and Alicante and one third Petit-Bouschet and Cuisaut. Carignan and Alicante produce harsh wines and Petit-Bouschet and Cuisaut yield soft wines with delicate flavour and therefore are used as correctives. For the production of white wines, Clairette predominates, and wines made wholly of Clairette grapes are given preference.

The vintage usually begins on the 16th. of August and continues until late in September, the density of the must during this period varying from 13 to 16o. Baumé. By a singular phenomenon which occurs in very warm summers, the process of maturation is frequently arrested when the formation of sugar is only partly completed. This untoward occurrence is at once detected by the growers, who on tasting the half ripe grapes, note that there is no longer an appreciable difference in sweetness between the tissues underneath the rind and those in the internal part of the berry, which, of course, means that the formation of sugar has stopped, and the sugar contents have become evenly distributed throughout the tissues of the berry. This empirical method of observation is further supplemented by the frequent use of the Baumé Mustimeter, which shows that the density of the must has stopped at 12 or 13 degrees and shows no tendency to increase by delaying the vintage. This phenomenon is generally attributed to a too early exhaustion of the natural moisture of the soil which interferes with the free circulation of the lymph and with the normal development of the physiological functions of the vine. Under these conditions the vintage is proceeded with earlier, and all the fruit is picked before the end of August. The wines produced from such physiologically unripe grapes are harsh and acid, and contain only 10 or 11 per cent of alcohol, so that it becomes necessary to blend such wines with finer and stronger wines of former vintages, and to place them at once on the market for consumption.

The fermentation of red wines is always conducted in open vats with submerged heads and great attention is paid by the wine-maker in Tunisia to prevent the marc from rising to the surface, as the least exposure to air is conducive to acetification. Healthy fermentation generally lasts for four days and by the end of that time all the sugar is converted into alcohol.

The temperature of the must during fermentation varies from 30 to 40 degrees C. When it rises above 33 degrees C. the fermenting juice is separated from the marc and put into

another vat for six hours. It is then pumped back over the marc to resume fermentation, which subsides more or less by this treatment, and a reduction of 6, 8 and sometimes 10 degrees C. in the temperature of the must is thereby effected, which, of course, proves very beneficial to the whole process of fermentation. However it often happens, through improper manipulation, that the must gets overheated and a portion of the sugar remains unfermented, so that the density of the wine produced results of 2 or 3 degrees Baumé.

In order to complete the fermentation of such wines, a small quantity of fresh must is taken and placed in another vat to ferment. As soon as it shows a vigorous fermentation an equal volume of the partially fermented wine is slowly poured upon it. By this addition, fermentation subsides for a few hours, but is soon resumed again very actively and then a second addition of the partly fermented wine is made of the same quantity as on the first occasion, and this operation is repeated until the whole of the partly fermented wine is submitted again to fermentation. The process usually takes from 15 to 30 days and is generally successful, but the wines so obtained lack some indeterminate qualities which make them at once inferior to wines obtained from normally fermented musts.

When fermentation is complete the new wines are pumped into vats and treated with liquid SO_2 at a rate not exceeding 100 mg. per litre. The marc is pressed and the « vin de presse » is usually distilled, but is sometimes reserved to give body and colour to poor wines. The new wines are devatted four times during the first year and twice during the second and again during the third year, and at each devatting the casks or vats are slightly sulphured; but sulphuration is never so abundant or intense as in Algeria and Spain.

It is a warmly debated question, both in Tunisia and in other wine-growing countries, whether wines age equally well in cement cuves as in wood. In the opinion of most vintners, substantiated by long experience, wine matures better in wood, and accordingly, not only in Tunisia but in all wine-growing countries, the finer produce is always kept for three years in casks before bottling. It is generally recognised that wine is a « living » produce and it is supposed that the chemical activities which go on in the wine itself during the process of ageing, are best developed in wood, which owing to its porosity permits a slow diffusion of atmospheric oxygen, with its attendant processes of oxidation. The funny side of the question is that the warmest advocates for the maturing of wines in cement cuves invariably keep their finest wines in wood and regale only the ordinary wines to the keeping of the cement cuves.

In Tunisia fine, red table-wines are usually bottled in the third year after vintage. Such wines keep well indefinitely and acquire very fine qualities by the ninth and tenth year. Poorer wines are usaully disposed of as « vins ordinaires ». Some vinters, however, bottle their wines indifferently at the close of the first year, but such wines are usually meant for consumption during the next year and are at their best at about the sixth month after bottling, and if kept longer they throw down abundant deposits which mar their appearance.

White wines are prepared mostly from Clairette and Ugni blanc. Continuous presses, like those in use in Algeria are employed for the vintage of these wines, and the skins are of course, fermented separately for distillation. Most of the alcohol obtained from the distillation of the fermented skins is employed for the preparation of the « mistele wines », but a small quantity of Cognac is also produced. The musts of white wines are sulphured with liquid sulphur dioxide at the rate of 100 mg. per Lt. After two days an abundant precipitate is formed,and the liquid clears. The liquid is then devatted, and aerated to remove any excess of sulphur dioxide and then it is allowed to ferment when, owing to the presence of this substance, it usually undergoes a slow but healthy fermentation. Subsequent treatment does not differ from that employed for red wines; but the second application of sulphur dioxide is made at the same rate as the first, and this imparts to the wines a very strong sulphurous taste and smell which they lose only after long years of keeping. In some caves the white wines are stored in wood for two or three years and this greatly improves their « goût » and « bouquet » but generally they are bottled during the first or second year after vintage for immediate consumption.

The « vin rosée » is produced on a much larger scale in Tunisia than it is in Algeria. The cepages employed for the preparation of this wine are Alicante and Petit Bouschet, sometimes mixed with small quantities of Clairette. The crushed berries are treated with liquid sulphur dioxide at the rate of 100 mg. per litre and are then left to themselves. A small quantity of colouring matter which is sparingly soluble in water, is dissolved in the must, thus imparting to it a faint rose colour, which is the principal character of the wine. In two days the upper portions of the liquid start fermentation and the liquor is then immediately pumped into another vat, while the marc is pressed and the exuded juice is added to the fermenting must. Just as is the case with the white wines, owing to this treament with sulphur dioxide, fermentation is usually very healthy and the temperature of the fermenting must rarely rises to 33o C.

Tunisian table-wines suffer very frequently from the appearance of « flor » (Mycoderma vini and Mycoderma aceti,

which generally grow together, forming thin pellicles on the surface of the liquid). Red wines suffer more than white wines by the development of these microrganisms; but in both cases the constitution of the wine is deeply altered to the worse. The usual practice is to treat infected wines by devatting at once, and then by filtering and fining. In severe cases, however, the wines are also pasteurized at 60o C. or more. The red wines of Tunisia contain from 12 to 14 per cent of alcohol and the white wines from 12½ to 13½ per cent.

The caves of Tunisia are built on the same design as the caves of Algeria, but the vats employed are much larger and the cement cuves generally have a capacity of 1,600 Hl. while wooden vats of 800 Hl. are quite common. A very modern establishment, where all the methods of wine-making and wine-keeping in Tunisia can be followed with advantage is that belonging to Messrs. G. & E. Licari, at Khangnet el Hadjaj. In this establishment 16,000 Hl. of wine can be stored in one section of the cave. The building consists of two oblong wings, forming the caves, and a central intervening block containing the fermenting vats and machinery. The caves are not all of the same size. The larger cave is 50 m. long and 22 m. broad, and contains 10 cuves of 1,600 Hl. capacity, two of 800 Hl., and four of 400 Hl. These cuves are made of armed cement lined with glass. The smaller cave is of the same length, but narrower, and contains a number of big wooden vats or casks and six or seven large cement cuves dug in the ground. The temperature of these caves varies from 17o to 22o C. All the machinery used, viz., crushers, pumps, filters, etc., are worked by electricity and are of the latest type, and accessory to this establishment which covers about 400 hectares of land, mostly vineyards, there is also a large workshop, some stores and two stables each accommodating 50 mules for the necessary tillage and other forming operations.

PORT-WINES, SHERRIES AND OTHER FORTIFIED WINES.

Port-wines.— Port wines are the produce of a narrow strip of land along the Douro Valley, known as the Upper Cargo. No wine has been subjected to more fraudulent imitations than Port-wines, in Portugal as well as abroad; but genuine ports have remained unequalled in fragrance and mellowness or to use a stronger expression, they have proved inimitable.

The Port-wine industry is almost entirely in the hands of English firms and some of them can trace back their activities to the seventeenth century. In the early part of the sixteenth century some English settlers at Oporto procured these wines at very low prices and either shipped them to England or supplied them to the English Fleet which in those times made frequent callings at that port. The increasing demand created for these wines induced the original settlers to extend the vineyards on the Douro, and in 1703 the «Porto» wines were granted preferential duties in England by the Methuen Treaty. According to this treaty, French wines paid £55 per tun, while Port-wines paid only £7 per tun. Thus favoured by legislature, the Port-wine industry grew very rapidly and in a few years Port-wines acquired a well-deserved popularity in England, which they have retained to this day.

On the Douro, both red and white port-wines are prepared; but although the white ports are really remarkable wines, both for flavour and « bouquet », they are produced on the Douro on a very limited scale, and are usually outclassed by the white «Porto do Sud» which is manufactured in Estremadura, and to which reference will be made when the rather important fortified wines of that district are considered. Red Port-wines are the all-important produce of the Upper Douro, and these are distinguished as « Vintage Ports » and « Tawny Ports ».

« Vintage Ports » are the outcome of the finer vintages and are usually bottled with the respective year of the vintage carefully noted on the label, while «Tawny Ports» are the produce of the less successful vintages, carefully matured for long years and then blended to produce the standard type.

The grapes usually employed in the preparation of red Port-wines as indicated to me by Mr. Josè Duarte d'Oliveira, author of the « Vinificacao Moderna » etc., are: Alvarelhao, Cornifesto, Touriga, Souzao, Tinta Carvalha do Douro, Tinta Francisca and Albino de Souza. The first four of these, namely, Alvarelhao, Cornifesto, Touriga, and Souzao are remarkable for their colour and acidity. These grapes are vintaged as they come to the lagars and not in well definite proportions. Formerly there were used two other varieties of grapes which formed by far the largest proportion of the grapes vintaged; these were Bastardo and Donzellinho do Castello which have now practically disappeared from cultivation. Many old and excellent Ports still in existence are the produce of these wines. However, as they ripen too early for a late vintage in Septemper, they were gradually supplanted by the cepages above mentioned. The grapes are vintaged when they are perfectly ripe or a little over-ripe, and the must is generally tested before vintage, until it shows a density of 12o. B. This generally happens by the 27th of September, but

vintages of Port-wines are recorded on the 24th, 23rd, 22nd, 21st, and 19th of September, and under very rare and exceptional circumstances even on the 4th and the 1st of August. The grapes are gathered in osier baskets and are carried on shoulder to the lagars. There they are sifted and crushed and a number of bare-legged men then enter the lagar and continue the crushing with the feet to the tune of a lively accompaniment of string instruments, which are generally in attendance. This operation of crushing the grapes by the feet lasts for about 4 hours, at the rate of 2 men for each pipe (500 Lt.) of wine to be produced. The next day, it is resumed, for a further period of 4 hours by half the number of men, that is, one man for each pipe of wine, and the operation is repeated a third time twelve hours after, that is, on the evening of the second day, and for a fourth time on the morning of the third day; each time employing the same number of men, that is, one man for each pipe of wine.

When the density of the must falls to 7 or 6 degrees B., the liquor is pumped into casks containing brandies at 77 per cent of alcohol. The quantity of brandy employed for each cask of one pipe is one hundred litres, so that the proportion of the brandy to the fermenting must employed would be 100 Lt. of brandy to every 450 Lt. of fermenting must. This will bring the resulting mixture to about 18 per cent of alcohol and consequently fermentation is arrested at once.

The fermentation of Port-wines begins at a temperature of 18o C. and stands best at 20o C. However, the temperature continues to rise until it reached 30 to 31o; and after that it is closely surveyed and, if it reaches 32o. C., artificial refrigeration is usually resorted to. The atmospheric temperature for the months of August and September. 1912, gave the following readings:

August — Max. in Sunshine ... ... 45o C.
Max. in shade ... ... 29o C.
September — Max. in Sunshine ... ... 50o C.
Max. in shade ... ... 31o C.

These figures should cause no alarm because the last days of September are remarkably cool, and the temperature often falls to 20o C. in the shade, and then usually it remains stationary for four or five days.

The young wines are left without any further treatment until the cold season sets in, and then they are conveyed down the river to Villa Nova de Gaya. On reaching Villa Nova de Gaya more brandy is added to the wines, so as to bring the alcoholic strength to 20 or 21 per cent. The wines are then examined for colour, body, acidity and sweetness and if they prove of a sufficiently superior quality, they are blended to-

gether to produce a « vintage wine » for that year, otherwise they are reserved to blend variously in order to produce « Tawny Ports ».

Vintage wines are kept for two years in casks and then bottled, but Tawny Ports are kept in casks for any number of years in order to mature slowly or to « tawn ». Tawnying consists in the slow oxidation of the colouring matter which is gradually thrown down. For this purpose the casks are not kept quite full and are usually plugged lightly. In some cases they are also devatted every year, to accelerate tawnying, but this practice is not universally adopted, and when cool stores are available it is never resorted to. As already stated, « Vintage Ports » are bottled after keeping for two years in wood, that is, in their original casks, by which time they develop all their good qualities; they may however, be kept in glass for any number of years and continue to improve by keeping. Tawny Ports acquire their good qualities in about 20 years, when they can be bottled, otherwise they begin to deteriorate but if cool stores are available the process of tawnying may be extended to forty years or more with advantage, the wines acquiring a fragrance and mellowness obtainable in no other way. For commercial purposes, however, the process of tawnying is more often accelerated than retarded and this is effected by annual devattings, when the wines mature in about ten years sufficiently well for bottling.

An important factor in the making of Port-wines, which is usually overlooked, by the majority of the vintners, is the degree of acidity. The must may have an acidity varying from 5 to 9 per cent expressed as tartaric acid. In the opinion of Mr. Josè Duarte d'Oliveira, many good vintages which go to produce tawny ports, could produce vintage ports by the proper acidification of the must. Such an acidification should, of course, be made before fermentation is started, in order to ensure a good colouration of the must of the resulting wine, the solubility of the colour of the skins being greater in an acid medium. In some factories at Villa Nova de Gaya, the wines are devatted four times during the first year after vintage, just like ordinary table-wines. The object of this process is to hasten still further the tawnying of the wine for commercial purposes; but « fine old Tawnies » are never obtained by such treatment.

The excellent qualities of « fine old Tawnies » are best shown in such brands as « Royal Reserve », « Imperial » etc., prepared by Messrs. W. and J. Graham & Co. Ltd., of Villa Nova de Gaya. These brands are characterised by a « finesse » which is superior to that of other tawny ports. Messrs. Graham & Co. do not vintage wine either on the Douro or elsewhere; but they buy their wines from the big producers or owners of «quintas» or from the small tenants on the Upper Douro and transport them to their stores at Villa Gaya during the cold months

of December and January, following each vintage. So far their methods do not differ from those of the majority of dealers in Port-wines at Villa Nova de Gaya. The secret of their success consists, therefore, in the judicious blending and skilful storing which the wines receive at their hands, to which I am going to refer.

The young wines, at the time that they reach the Graham stores generally contain 17 per cent of alcohol. They are at once blended together according to their alcoholic strength their degree of acidity and their intensity of colour. The wines selected to form vintage-port are brought to 20 or 21 per cent of alcohol with pure brandies, but no brandies are added to those which are meant to form tawny ports. Both types of wine are allowed to stand in their casks for three or four months after which they are pumped into big vats capable of holding from 120 to 150 pipes each, and in these they are allowed to mature for two or three years. At the close of the second or third year vintage wine is bottled or it may be stored in big casks completely filled, with the cork tightly bunged, and the casks set inclined so as to wet the cork. A better storage is afforded by glass coated cement cisterns of which Messrs. Graham and Co. have constructed several capable of holding 50 pipes each. Tawny wine, on the other hand, is stored in casks, not quite full but likewise tightly plugged. The wine is occasionally devatted to remove the lees, but it is sometimes left unmolested for a continued period of several years.

The process of ageing becomes very slow by this method of keeping. It is never accelerated by agitation, by the access of air or by any other contrivance, and to this slow ageing is due the peculiar «fiinesse» of the Graham Ports, which makes them so particularly acceptable. Sometimes wines of different ages are blended together to produce well defined standards. This blending applies only to the tawny wines which are practically always the result of several vintages, and does not apply to vintage ports proper, which are always the produce of the vintage of some particular year. Vintage-ports can always be transferred into tawny ports by the process of tawnying, but such a practice is, of course, unreasonable and never resorted to, owing to the higher commercial value of the vintage-ports.

As already stated, the fermentation of the must is stopped by the addition of alcohol, when the density of the must has come down to 6o B., but tawny port wines of a sweeter type are also prepared and the sweetness is imparted by the addition of a wine called Geropiga, containing 12 per cent of sugar and 20 per cent of alcohol. The Geropiga wine is prepared from the port-wine vintage, but the must is not allowed to ferment and is brought to 20 per cent of alcohol at once so as to retain all its sugar.

The casks and vats are always made on the premises, and in some factories there are interesting steam-cooperage plants. One of the largest of these plants is that of Messrs. M. de Souza Guedes & Irmao, Ltd. who are both vintners and exporters of port wines and handle all the produce of the Quinta dos Carvalhas the Quinta dos Baratas and the Quinta do Seixa - three large vineyards near Pinhao, some kilometers higher up the river than Regoa. The wood usually employed for the making of casks is oak, when obtainable, but chestnut and Frejo wood are also employed. Oak was formerly imported from Russia but, owing to the impossibility of obtaining adequate supplies, it is now largely substituted by Frejo wood, which is imported from Brazil. I was given to understand that Frejo wood was not originally imported into Portugal for the express purpose of making wine-casks, but a large quantity of wood being accidentally available, it was utilized for this purpose and has given such good results that many wine merchants now recommend its use very warmly. Casks are also made of chestnut wood of local growth or imported from Sicily, but this material is not much employed for the finer wines. Mahogany is employed for the construction of large vats, for the storage of wines for long periods, and it is believed that this wood is more resistant than either oak or Frejo wood.

New casks are usually treated with ammonia at the rate of $\frac{1}{2}$ litre for each cask of 450 litres. The liquid ammonia is poured into the casks and then a jet of steam at high pressure is introduced. The ammonia volatilizes immediately and chars the wood very effectively and dissolves all its tannin, while the steam disinfects the casks very thoroughly. The casks are then rinsed with cold, fresh water and afterwards disinfected with sulphur tape in the usual manner. In some factories, however, the casks are not submitted to any chemical treatment but they are washed with water and a chain, until no more tannin is dissolved.

The Graham stores are probably the best example of wine stores at Villa Nova de Gaya. In reality there is only one large store containing all the wines, the other portions of the building being used mostly as workshops. The wine-store is a spacious rectangular, almost square building, with a double roof to maitain an even temperature, supported on iron pillars. The space is divided into squares by a net-work of rails for the conveyance of the casks on waggons, and the casks are piled in pyramids, the lower ones having a common wooden support about 30 cm. high above the ground. The place is well ventilated by means of windows, and light is not excluded.

Almost all the wine-stores at Villa Nova de Gaya are built on the same general plan, the difference being in the shape and extent of the building, or what is more important in the situation which it occupies on the hillside. Those along the

banks of the river present some advantages for the easy conveyance of the casks, but are not so favourably situated for the storage of the wine which appears to fare better up the hill in more ventilated and cooler sites. Sprinkling the floor of wine-stores with water is, however, universally practised to keep the stores in a cool condition throughout the summer.

Tawny ports in keeping lose a considerable portion of their alcohol, by evaporation and consequently there is always some danger of fire in port-wine stores from the vapours of alcohol floating about in the premises. This same remark applies equally in the case of all fortified wines and particularly of those types of wines which require some years to mature properly.

Sherries. — The true Sherry wine-growing district is restricted to a few square miles of level country surrounding the town of Jerez de la Frontera. Beyond this district there are numerous vineyards which extend all round for many miles but produce wine of a different type, chiefly table-wines of a more or less crude quality. The soils upon which the sherry vineyards grow may be classified into three groups, viz :

(a) The Afueras or clayey soils;
(b) The Barros or calcareous soils;
(c) The Arenas or sandy soils.

The Afueras, also known as Alba Ritza, which means white earth, extend to the North-West of the town and produce the best types of sherry. They include several districts, of which the most important are Carrasol, Macharmudo, Balboina and Anina. The most celebrated vineyards are at Carrasol and the best known and most important of these are the vineyards at Tuenrubia, Caballero, Romano, Salvador, Dulce Nombre, Jardinito and San Gayetano.

The Barros extend to the South and South-East and include the important wine-growing districts of Torrox, Anafferas and Tarplana. The Arenas are located to the East of the town, and include the districts of Abiertas and Suria; but the Arenas are not celebrated for the types of sherries which they produce.

The old vineyards which formerly covered the whole of this wine-growing region, have been destroyed by Phylloxera and reconstitution on American stocks have been carried out only in isolated patches of no great extent; so that the actual area under vines is at present much less extensive than a few decades ago. This reluctance to replant on the part of the growers is due chiefly to the faulty system of land tenure which still obtains in the south of Spain. At first the Riparia was used as stock and stood fairly well for sixteen years, but owing to the more or less calcareous nature of the soils the later plantations

made on Berlandieri stock, viz : Berlandieri x Riparia 420 A., Chasselas x Berlandieri 41 B. and also on Rupestris du Lot have given better results.

The vines grown in the Sherry districts are Palomino, Mantuo Castellano, Mantuo de Pila, Beva, Castellano, Sevillano and Mollar. For clayey soils, Palomino and Mantuo Castellano are preferred; this last and Mantuo de Pila are also grown on sandy soils, and the others are grown indiscriminately on other types of soil.

Palomino yields an early vintage and produces the best sherries. Mantuo de Pila is characterized by a very hard skin and keeps well for a considerable part of the winter, whether in the store-room or on the vine, and generally it is not vintaged until the first rains have softened somewhat its hard skin.

Vintage usually begins on the 8th of September and the grapes are gathered as they ripen and not in any well-defined proportions. The bunches are picked somewhat over-ripe and are carried to the factory in osier baskets. They are then spread for a few hours in the sunshine to dry a little upon round rush-mats, provided with four rings of the same material, for handling. They are then pressed, after passing them through a sifter to remove the stems, and the must is run into butt-casks and left to itself until November by which time fermentation is completed and the liquor becomes clear again. The grapes are pressed in cement or wooden lagars about 30 cm. deep and about 60 cm. high above the ground. Men in short knickers and leather boots studded with hobnails do the beating with the feet, while the must is run through spouts into wooden vessels and then poured into casks.

This is the classical method of vintaging sherry, and is still in use in many « bodegas » or wine-factories. In more up-to-date establishments, however, this method has been superseded by the use of the mechanical press, which is usually fixed in the centre of stone lagars. The grapes are first sifted for their stems and then pressed, and the exuding juice collected in small pits dug either in the lagar itself or on its outside. From these pits the juice is pumped into small casks of about 450 Lt. capacity, in which it is allowed to ferment. It is not usual to sulphur the must, but this practice is resorted to in some factories immediately after pressing. The apparatus used is made on De Silva's principle and consists of an erect cask supported on a wooden stand, about 75 cm. high. At the top of this cask there is a tube forming a draught which leads to a sulphur chamber, and close to the tube there is a pipe to which is attached the hose of an ordinary pump. The must is pumped into the cask, which is always kept not more than half full, and in its flow into the cask sucks the sulphurous fumes from the chamber of burning sulphur. The cask is thus kept

full of sulphur fumes, in close contact with the must, which gradually absorbs them and becomes charged with sulphur dioxide. (Fig. 5).

When the fermented juice settles down and becomes clear again, the taster immediately begins his all-important work for the proper classification of the wines. Although the produce of the same grapes and of the same vintage the wine in each cask has what many be rightly called individual characteristics. Those wines which remain of a light colour, and have a delicate and dry taste and show no trace of a bouquet are marked with a sign which means « palma ». They produce the best sherries or the « fino » class. Those which show a yellowish colour and have a nutty taste and a slight bouquet clearly distinguishable are marked with a cross, meaning « palo cortato ». They produce second class sherries or the « oloroso » class. Those which have a reddish yellow colour, a big taste and an unpleasant odour, are marked « raya » and produce ordinary sherries.

Types intermediate between the « fino » and « oloroso » are marked with a cross and « palma sign » combined, meaning « palma cortata », and are considered a second quality of the « fino » class. On the other hand casks which are smelly but not sour are marked with two parallel erect lines, meaning « 2 rayas ». They form the lowest grade of sherry and go with the third class.

Some of the casks often go sour; these are either distilled at once or are left to become vinegar. The number of casks which go wrong is always considerable, and a distilling apparatus is a necessary adjunct to every factory. In these distilleries the still is not heated by steam but by direct contact with the fire.

When the work of classification has been completed, all the wines are fortified with alcohol. The « fino » type are brought to about 15% the « oloroso » type to about 16% and the « raya » type to about 17%, slight variations in the type being frequently allowed for.

A characteristic of the Jerez vintages is the formation of a pellicle called« Flor » on the surface of the wine, in spite of the fortification to 15, 16 or 17%, which appears during the first two months after vintage and is well developed by November, and continues to appear on the same wine every year at about the same time. This pellicle is formed of some species of Mycoderma which develops variably on different types of wine, and accordingly serves in a most unerring way to determine the class to which a young wine belongs.

The « Flor » develops of white colour, on « fino « types, grey on « oloroso » types, and yellowish or brownish on the « raya » types. It is in no way considered as a disease or as an

PITOLET's REFRIGERATOR.

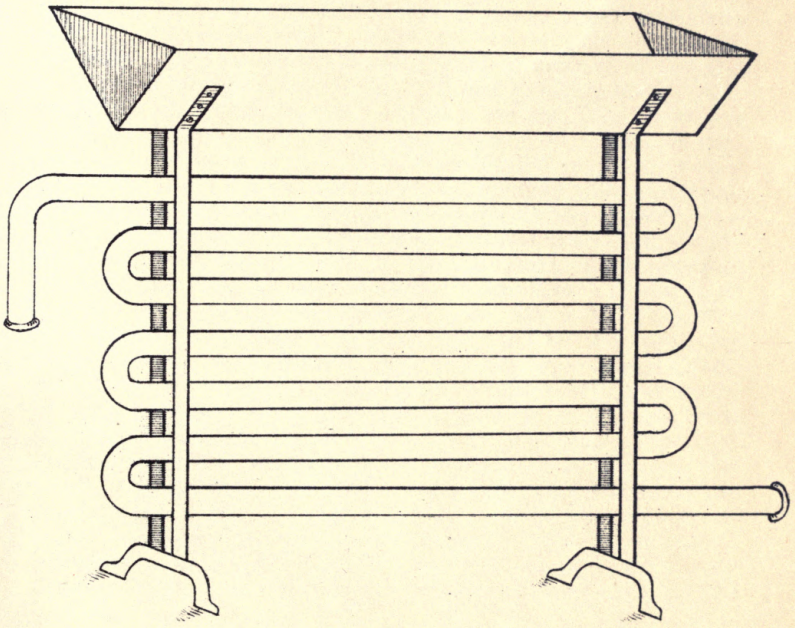


Fig. 4.

inconvenience; on the contrary it is believed to assist the Jerez wines in developing their valuable qualities. The « flor » develops in contact with the air and for this purpose the casks are always kept open or very lightly plugged; and it is removed permanently before shipping or bottling by fining, which is made with isinglass at the rate of 200 cc. of a ½% solution per butt.

Most vintages are distinguished by the name of the vineyard of which they are the produce; but the pick of the « Alba Ritza » and « Macharmudo » constitute together a distinct type of Sherry known as the « Amontillado ».

Sherries are not much affected in storage by either heat or cold. Very often some casks are allowed to remain in the open, exposed to the direct rays of the sun, and sometimes only a rudimentally shed is employed. In most of the « bodegas » or cellars, however, a well-organised method of keeping is followed, which taxes all the skill and patience of the vintner. This is known as the « Solera » system. The casks are piled in pyramids of three or four layers, on a wooden support to keep them from sliding. Once placed in position they are never moved throughout the whole period of their existence. The casks of the lowest row are marked with the number « 1 » those of the second row with the number « 2 », those of the third row with the number « 3 » and so forth. Each pyramid contains one class of wine, namely, « fino » or « oloroso » or « raya » and possibly one kind of wine, say « Amontillado » or a particular vintage . This is indicated by the respective sign, and by the name of the vintage, say Dulce Nombre, or by the word « Amontillado ». Every year the quantity of wine required for bottling or disposal is withdrawn from the bottom casks at the rate of 1/10th from each. These are refilled from the second layer of casks, the second from the third, and so forth; the upper layer being refilled from the year's vintage. In the best « bodegas » the fourth layer of casks is refilled from the bottom layer of a younger pyramid, bringing the total number of rows to seven. Thus a good Sherry usually attains a considerable age before it is put on the market.

Sherries are typical dry wines with a slightly bitter taste, better marked in the lighter coloured or «fino» types than in the darker or «oloroso» types; but sweet sherries are also prepared on practically the same scale as the dry sherries. This is done by blending with a wine called « Apagado ». It corresponds to the « Geropiga » of the Port-wines and is made in the same way, wtih 20% of alcohol. It is usually left to rest for two months after making and it is then devatted, and may be employed at once for any purpose of blending. Sweet sherries are therefore stronger in alcohol.

Pedro Ximenes. — A peculiar type of wine is also prepared at nearly all the bodegas ofJerez. This wine is known as Pedro Ximenes. It is a heavy, almost black, syrupy wine, with a pleasant bouquet and a molass taste. It is prepared from the fruit of a cepage called « Pedro Ximenes ». This vine is reputed to have been imported from the Rhine district by a certain Peter Simons, and is stated to be the same vine which produces the famous « Hock » wines. The grapes are gathered on the 1st September or thereabout, when they are over-ripe. They are then allowed to dry in the sunshine and to attain the raisin stage. Care should be taken not to let the grapes get wet with rain or dew, and consequently they should be put under cover every evening. The time taken to attain this stage varies from 15 to 20 days, according to the condition of the atmosphere. They are then pressed and the must is run on alcohol to bring it to 20% . Like all wines of this type it can be consumed shortly after, but it is generally kept to mature for two years.

Malagas. — In the Malaga district, fine types of Malaga wines are produced, viz : Malaga Sherry, Peroxinée, Paxarete, Lacrima Christi and Malaga-Brown and they are all prepared in the same manner from Pedro Ximenes and Muscatel grapes. In the vineyards around Malaga there are more than 80 sorts of grapes but only the two sorts above mentioned are employed in the manufacture of Malaga wines. Most of the other sorts are consumed as table grapes and some of them are made use of in the manufacture of table-wines of no particular interest.

The grapes are gathered as soon as they are ripe, usually after the 8th September; when the must shows 14 - 15o B. and are immediately pressed in strong hydraulic presses, out of which the husks are drawn practically dry. The must is run into pits on the floor and is then pumped into casks, where it is left undisturbed to ferment for one month. By this time the must shows 0o B. that is, all the sugar has been transformed into alcohol. The percentage of alcohol is then accurately determined, and enough brandy added to bring the strength of the alcohol to 14%. This is the process of the manfacture of the Malaga-Sherry, which is a pefectly dry wine.

Peroxinée, Paxarete and Lacrima Christi are prepared in the same way, but in their case the course of fermentation is stopped by the addition of alcohol, when there is still a residue of unfermented sugar. For Peroxinée the fermentation is stopped when the must shows 4o B., and for Paxarete and Lacrima Christi when the must is still at 6 and 8o B. respectively. In all cases the strength in alcohol is brought to 17 per cent.

Malaga-Brown is a blend of Malaga-Sherry and of Pedro Ximenes wine prepared on the spot by the same process of manufacture as at Jerez. The blend is made by adding, in various

proportions, Pedro Ximenes to Malaga Sherry until the mixture is brought to 17% of alcohol and 10% of sugar.

Malaga wines, after the process of fortification, are left in open or lightly plugged casks for one year, during which time they throw down abundant deposits. They are then clarified, filtered and bottled for sale. However, Malaga-Brown is usually kept for two or three years in casks, by which time it perfects its bouquet to advantage. Unlike the other Malaga wines, it is a red or purplish brown wine, although prepared from white grapes, on account of the Pedro Ximenes wine which it contains and from which it derives its colour.

Malaga wines improve by keeping, but do so rather slowly, this slow improvement, however, being compensated by the « finesse » which they acquire. In the stores of Messrs. Larios y Cia, Ltd., there are Malaga wines over one hundred years old.

Malaga wines are usually devatted two or three times during the course of the first year, in order to remove the precipitated matter, although the operation is not done at fixed intervals. Clarification is practised by the addition of about 25 grammes of gelatine for each butt of wine, and filtration is made through paper, at a low pressure. The paper filters are usually broken up after use, washed, dried and used again.

The great trouble with the Malaga wines is that at a low temperature they are apt to become turbid. This inconvenience is easily removed by refrigerating the wines to 15o C. and then clarifying and filtering, but although there is a refrigerating apparatus in most bodegas the operation is not much practised.

The bodegas in which the wines are stored are not remarkable either for construction, exposure, temperature or even cleanliness. They are ordinary stores without any special feature and the casks are piled in pyramids to save space.

A type of wine which is worth mentioning and which is likewise prepared on a large scale in Malaga, is « Muscatel » wine. This is prepared from Muscatel grapes by the same process of fermentation which is employed for the other Malaga wines; but fermentation is stopped at 8o B. by the addition of alcohol to bring the alcoholic strength of the liquid to 16-17%.

Tarragona Port. — « Tarragona Port » is a red « liqueur wine » containing 3% of sugar and 15 to 16% of alcohol. It is prepared by blending a red table-wine called Tarragona Campo, to which reference has already been made in connection with the other Spanish table-wines, and which contains from 14 to 16% of alcohol, and a « mistelle » wine prepared from the same grapes out of which Tarragona Campo is prepared. Tarragona Campo is never employed for the preparation of Tarragona Port until it is well matured in casks;

but the sweet wine with which it is sweetened may be quite new. Tarragona Port is always kept for two or three years in lightly plugged casks before bottling, and continues to improve by keeping whether in wood or in glass.

Some other sweet wines. — Many other liqueur wines are prepared in Western Europe and Tunisia, but few of those prepared in the regions visited by me have any importance from a commercial point of view, except at Estremadura in Portugal, where sweet wines of a very superior type are prepared on a large scale. The most important of these wines are :

Red and White Porto do Sud,
Muscatel Setubal,
Abafado and Beneficiado.

Red and White Porto do Sud. — These two wines are prepared in imitation of the red and white Port-wines of the Alto Douro, and contain 17% of alcohol. The grapes employed for their manufacture are :

For the Red Porto do Sud - Ciriquita, Jouo-Santarem and sometimes Arinto and Ramisco.

For the White Porto do Sud - Fernao Pires, Arinto, Boal and Muscadel.

Red Porto do Sud, whether a vintage or a tawny wine, resembles the corresponding type of the Douro, but is much weaker both in flavour and bouquet. However, white Porto do Sud is really a very superior wine, of a light amber colour, remarkable for its fragrance as well as for its pleasant sweet Muscat taste which is very persistent in the mouth.

Moscadel Setubal. — This is a white Muscat wine containing 17% of alcohol and 6% of sugar. It is prepared from « Moscadel Setubal » grapes, by fermenting the must until it is brought to 6o B., and then stopping fermentation by runnig the fermenting must on pure brandies, in order to bring the resulting wine to 17% of alcohol. Here it may be remarked that most sweet Muscat wines are prepared in this manner, but sometimes the whole of the sugar present in the grapes is retained by running the fresh must on brandies, and bringing to the required strength, without any fermentation.

Moscadel Setubal as well as Red and White Porto do Sud, are manufactured by the « Companya dos vinhos ed azeites du Portugal », to which reference has already been made. This Company manufactures also the celebrated wines of Madeira, which, like Moscadel Setubal, are prepared from Muscat grapes; in this case, however, the variety employed being « Moscadel Madeira ». In the preparation of Madeira wines, the grapes before pressing are baked in an oven, where they are exposed for some time to a temperature of 50 - 60 degrees

C. to which process the peculiar « goût de noix » of the Madeira wines is due. I had no occasion to visit Madeira, but the process of manufacture of the Madeira wines should be particularly interesting because, besides the excellence of the wines themselves and their peculiar character, they are also the object of numerous imitations.

Abafado and Beneficiado. — These two sweet wines contain about 17% of alcohol and both are prepared from Malinha and Joan Paulo grapes. The two wines differ only in the method of manufacture, Abafado being an unfermented or « mistelle » wine, and Beneficiado a partly fermented wine. In the case of Abafado the alcohol is added before fermentation is started, by running the freshly drawn must on the quantity of alcohol required to bring the resulting wine to 17%. Fermentation is thus arrested at once or rather prevented altogether, and the wine retains all the sugar of the must. On the other hand Beneficiado is a partly fermented wine, the fermentation of which is checked when the density of the must has descended to 6 or 7 degrees B., like the Port-wines of the Douro. This is effected by the addition of ten litres of alcohol at 78% per hectolitre. Both these wines are allowed to age in casks for two years, before they are disposed of or before bottling.

In the preparation of sweet or desert wines, collectively designed as «vins de liqueur» by the French, two distinct processes are followed, viz : the Mistelle process and the Port-wine methods of the Douro. The French word « mistelle » is derived from the Spanish word « mistela » which is still in use in Spain and means mixture, because the wines prepared by this process are not true wines but liquors consisting of a mixture of grape must and alcohol, in such proportions as to inhibit fermentation. In fact, these wines are brought up to 20% of absolute alcohol, and the resulting liquor is fit for consumption at the close of two months or thereabouts. The Geropiga of the Douro the Apagado of Jerez and Pedro Ximenes wine are prepared by this process; but besides these rather important wines similar wines are prepared everywhere in Spain, Portugal, the South of France and Tunisia, most of which are wanting in those qualities which secure a commercial importance.

On the other hand ,wines prepared according to the Port-wine methods of the Douro, always compare better with « mistelle » wines, and often by keeping for a few years develop all the characteristics of a superior wine. These partly fermented wines are prepared by reducing the density of the must to 8, 6 or 4 degrees B., by partial fermentation and then impounding the residual sugar by the addition of alcohol. In order to obtain wines of this type, of fine quality, the addition of alcohol should not be more than 10% of absolute alcohol by

volume, and the French laws distinguish such wines as « natural sweet wines ». This limited addition of alcohol necessitates the selection of high density musts for the preparation of these wines and accordingly grapes which yield musts of less than 15o B.,are always discarded. As already stated, the musts of the Port-wines of the Douro show 15o B., but musts of 18o B. and even 20o B. are frequently employed in the preparation of wines of this type. The Port wines of the Douro, the Red and White Porto do Sud and Beneficiado, Peroxinée, Paxarete and Lacrima Christi are all superior wines prepared by this process and their preparation has already been referred to in detail.

In the preparation of wines by either of the processes mentioned above, the addition of alcohol should not be made by dropping the alcohol on the must, but by running the must on the alcohol, which has the effect of paralysing the ferment; otherwise fermentation will continue for some time and will not stop until a large portion of the sugar is transformed into alcohol, thereby greatly reducing the sweetness of the wine.

Immediately after the addition of alcohol, both to fresh musts and to partly fermented musts, there should always follow a brisk agitation in order to bring the mixture to uniformity. Subsequent clarifiication is generally spontaneous and as a rule abundant deposits are thrown down during the first few days; but sometimes on account of persistent turbidity, mechanical clarification and filtration become necessary.

The temperature of fermentation is also an important factor in the preparation of sweet wines. As already stated the best temperature for vinous fermentation ranges between 18o and 21o C., for all types of wine, but sweet wines are much more easily affected by a rise of temperature, and natural sweet wines are for this reason closely surveilled during fermentation, and as soon as an appreciable rise is noted, recourse is had to artificial refrigeration.

Sweet Sherries are prepared by blending a fortified dry sherry with Apagado. This method is closely followed in the preparation of many sweet wines, the most important of which is Malaga-brown, which is prepared from Malaga Sherry and Pedro Ximenes. Wines prepared by this process mature very quickly, generally in one year, keep very sound and often improve considerably by keeping. In some cases the dry wine employed is not fortified by the addition of brandies, but is a natural table-wine like Tarragona campo, which is employed in the manufacture of Tarragona Port by blending with a « mistelle » wine in order to bring to the required sweetness.

There is a growing tendency among sweet-wine makers to prepare sweet muscatel wines, which appear to be gaining favour with consumers. In the preparation of these wines, the

« mistelle » method is sometimes followed, but the prevalent rule is to ferment the must until it is brought to 8 or 6 degrees B., before fortifying with alcohol. An interesting Muscatel wine is Muscatel Malaga, which is prepared from the grapes of that name and contains from 16 to 17% of alcohol. In the preparation of this wine the process of fermentation is stopped at 8o B.

Jerez and Malaga Brandies. — Before closing the subject of wine-making in Western Europe, it will not be out of place to make mention of the rather good brandies which are being prepared in Andalusia, particularly at Jerez and Malaga, and which, for purity, fragrance and mellowness compare favourably with some of the best cognacs of France. In Spain, the extraction of alcohol from wine is practised on a very large scale and is probably greatly encouraged by the fact already mentioned, namely, that Spanish table-wines generally go flat by the fourth or fifth year and the surplus production is, therefore, made use of for distillation. Most of the alcohol thus produced is destined for exportation or for industrial purposes but small quantities of brandies are manufactured almost everywhere. However, it is only at Jerez and Malaga that the brandies produced possess to a considerable degree those qualities which have contributed to build up the fame of the French cognacs.

During the preparation of Sherries and Malaga-Sherry many casks go wrong, either by acetification or by some other disease. This diseased wine is at once distilled and the overproof alcohol obtained is stored away in *new oak casks* for three, seven or twenty years, by which time it develops its finest characteristic qualities. So far no attempt has been made to redistill these brandies in order to obtain first, second and third class qualities, but I am convinced that the Jerez vineyards are destined to produce brandies of as good quality as the best cognacs of France.

Dry Muscatel grapes. — The drying of Muscatel grapes is a very important industry and is worth more than a passing reference. Considerable quantities of Muscatel grapes are dried every year and largely exported to the U. S. A., and during these last years, that is, since the Prohibition Act controlling the use of alcoholic drink in the U. S., the industry has been further developed very rapidly, with a corresponding reduction in the output of wine.

The method of drying as generally followed, is very simple. The best bunches are selected and are exposed to direct sunshine on sand, canvas or mats, for from 16 to 20 days, during which time care is taken every night to protect the grapes from the dew by a covering of canvas sheets. The bunches are also

frequently examined and turned over to ensure uniform drying, whilst spoilt berries are picked off, and the degree of dryness tested from time to time. When the desired degree of dryness is reached, the finer bunches are packed very carefully in 5 Kg. cases for exportation, and the smaller or broken bunches, which are discarded by the pickers, are pressed through a sifting and sorting machine which separates the single raisins in three or four sizes. These various grades are packed separately in bags or square wooden cases capable of holding 25 or 50 Kgs.

In the more up-to-date « haciendas » the process of drying the grapes in the sunshine is attended to with scrupulous attention as to cleanliness, and the contrivances used are also less primitive. The grapes are spread on elevated platforms of masonry, usually ten meters long and five meters broad. The platforms are surmounted by a framework of wood, about one meter high, over which a canvas covering is stretched by night to keep off the dew. Usually the grapes are allowed to dry on these platforms for about 10 or 12 days, and then the process of drying is finished off by the use of artificial heating in specially constructed chambers. These chambers generally consist of two rooms, one over the other, the lower one being an ordinary oven, roofed over with brickwork. An iron tube about 30 or 33 cm. in diameter, runs from the roof of the oven or fireplace into the upper or drying chamber, passes round the walls in three or four spirals and finishes out of the roof of this chamber, into the air like a chimney. A current of hot air is thus made to circulate within the upper chamber, which is generally kept close, although it is regularly provided with windows in order to lower the temperature, if necessary. The grapes are placed in rectanguler trays of tin or wood with a bottom of galvanized wire netting, of small meshes, and the trays are piled one over the other, in the heated chamber, on a large wooden frame in the central part of the room. The temperature of the drying room is kept at from 40 to 60 degrees C., and the grapes are usually left there continuously for two or four days.

In late seasons, that is, when the grapes mature late, it is not possible to do so without the use of a hot room to finish off the process, as then probably owing to the increasing atmospheric humidity, it is difficult to produce well-dried grapes simply by exposure to the sun. In fact even after a prolonged exposure to the sun, should the season be too far advanced, the grapes remain partly moist and quite unfit for packing.

Most of the dry grapes prepared in Malaga are exported to the U. S. A., and it appears that these grapes are not being exported for resale, but for the production of dry raisin wine.

THE PASTEURIZATION OF WINES.

Although sterilising machines are to be found in every wine-factory in Spain and Portugal, it is evident from the neglected state in which this apparatus is usually kept, that pasteurization does not find much favour among the wine-makers of these two countries. In France and Algeria, wine-makers do not, as a rule, keep pasteurizing machines, but there are special establishments for the purpose kept by persons dedicated to its technique. However, the pasteurization of wines is looked at askance and held in suspicion everywhere, especially in France, where none but diseased wines are subjected to the treatment.

By pasteurization is usually meant the process of destroying germs by heat, and therefore, in its widest sense, pasteurization is equivalent to sterilization. Such a process may be partial or complete. It is partial when not all the microrganisms present in a medium are destroyed, but only those which it is required to eliminate, provided that they succumb to a lower temperature than those which it is desirable to keep unimpaired. On the other hand, it is complete when all the microrganisms present in a medium are destroyed,and in such case the medium becomes sterile. So far as wines are concerned, pasteurization is intended to destroy only those pathological germs which impair their quality by inducing a diseased condition; but the process is usually applied in such a way as to destroy all living microrganisms in the wine, and, therefore, in this case it becomes a true sterilization.

Pasteurization, or the elimination of microrganisms, is also effected by filtration through porous earthenware, at least so far as filtrable germs are concerned; but this process has not yet been applied to the pasteurization of wines.

The principal types of pasteurizing machines employed have a continuous circulation so that the wine reaches the wine quite cool, and the empty casks are sterilized separately by a jet of steam. These machines are usually built on three systems, viz : (1) the coiled tube system, (2) the tubular bundle system, and(3) the cylindrical or heliodical compartments system. Machines built on the first or coiled tubes system are considered as obsolete, and although a few models are still met with here and there, they entail an unnecessary loss of time and consumption of fuel owing to which they are now mostly superseded by those of the second or tubular bundle type. These last offer many advantages both as regards economy in their working and in the facility for cleaning. They are, however, inferior to worm machines because they, relatively offer a smaller surface for the exchange of temperature. This drawback has been overcome by the cylindrical or helicoidal compartments system, but this type of machine is difficult to build and to clean and, therefore, so far has not met with much favour.

These machines are generally constructed on various patterns, each having special details of varying importance, to meet the particular exigencies of the locality where they are to be installed. The « pasteurizateur Perillot » is an interesting machine of compact construction, which is meeting with increasing favour especially in France, owing to its comparatively small cost and most easy handling. This machine consists of a series or concentric tubes of about 2 m. long, through which the wine circulates. A water jacket at the top contains that partion of these tubes which form the calefactor, while the rest, representing the refrigerator, are exposed. The wine entering from below rises in the tubes to the calefactor and in its course becomes heated by the descending column of pasteurized wine. In the calefactor, the wine is calculated to remain for ten minutes at a temperature of 80o C. It then descends and is cooled down by the ascending column of wine. Five thermometers show respectively :

(a) The temperature at which the wine enters the apparatus;
(b) The temperature at which it enters the calefactor;
(c) The temperature of the water-bath;
(d) The temperature at which the wine isues from the calefactor.
(e) The temperature of its exit from the apparatus.

Before running into the sterilizing machine the wine is passed through a Gasquet filter, and the pressure at which the whole apparatus is worked is usually 5 meters in terms of the water barometer.

The temperature at which wine is pasteurized in France is probably too high. In Spain wines are pasteurized at 60o C. when weak. A temperature of 65o C. is believed to be enough to destroy all pathological ferments infesting wines, and 72o C. kill the wine ferment, which under the special condition of a vinous medium is the last to succumb. A temperature of 80o C. leaves the wine sterile for all purposes, as most microrganisms die out at a much lower temperature in an alcoholic medium than in an acqueous or dry state.

Before being subjected to pasteurization, wines should be perfectly bright, and, therefore, a filter is a necessary adjunct to every pasteurizing machine, as the particles in suspension may dissolve under the action of heat and alter the « finesse » of the liquor. During and after pasteurization, that is, until the wine resumes its original temperature, it should be kept out of contact with air, as otherwise aerification will take place, that is the wine, while cooling, will absorb oxygen from the air with the consequent oxidation of the colouring matter and the alteration of the colour of the wine.

A practice which is largely followed in Tunisia and which appears to have some merits of its own consists in pasteurizing

diseased wines at 80o C., as in France, and then to run the sterilized wine in casks which contained sound wine. The thin film of wine ferment adhering to the sides of the cask soon impregnates the whole bulk and in about one year the wine regains almost entirely its original bouquet and « finesse ».

THE OENOLOGICAL INSTITUTES OF REUS AND VILLAFRANCA.

Through the courtesy of Don José Solè of Messrs. Mayner, Plà y Sugranes, of Barcelona, who acompanied me in most of my tours in the north of Spain, and to whom I am also indebted for most of the information collected on the Spanish table-wines, I had occasion to visit the twin Oenological Institutes of Reus and Villafranca, and to form an idea of their organisation. The Institute at Reus is both viticultural and oenological and is known as « La Escuela de Viticultura y Enologia de Reus ». There are attached to it an extensive experimental vineyard and several well equipped research laboratories, and under the capable management of its present Director, Don Claudio Oliveras Massò, who is well known throughout the whole of Spain by his numerous oenological and viticultural publications, it has made remarkable strides in scientific research and solved many difficult problems in connection with viticulture in Spain. In the experimental vineyards most of the American vines which can grow on the soils of Spain, are cultivated, each quality being planted separately in small rectangular plots of about 100 plants each. There are also extensive collections of the numerous cepages of the European vine which are grown in Spain, both as regards wine-grapes and table grapes. All the best-known methods of cultivating and pruning the vine are likewise well illustrated, and there are besides, special grounds set apart for the purpose where the resistance of American vines to Phylloxera and the resistance of direct producers and of European cepages to cryptogamic diseases is studied from year to year.

The school itself is a spacious building, built on a most modern style and is well equipped with the necessary apparatus for research work. There is a large lecture hall capable of accommodating a considerable number of students; there are also chemical laboratories, an experimental cave and a well furnished museum, the section dealing with the diseases of vines, having a very interesting collection of numerous and beautiful models of diseases in wax or stucco. The Institute is mainly

a high school of viticulture and oenology and its work is recorded in numerous publications and statistics which can be obtained on application to the Secretary, Don P. Garcia.

The Institute at Villafranca is known as « La Estacion Enologica de Villafranca del Panades » and partakes of the character of a technical school for small proprietors. It is not a viticultural station, like the Institute at Reus, but there is also a small vineyard attached to it for demonstration purposes, its scope being principally to illustrate the most approved methods of cultivation, as well as to furnish an adequate supply of grapes for the oenological branch of the school. Research work is conducted by the staff of this Institute on the same lines as at Reus and under the able management of Don Cristobal Mestre Artigos, it has made very rapid progress. Short progressive courses in viticulture and in the technique of oenology are conducted every year during the proper season. each course lasting for about 10 days of 8 or 9 hours each, and these classes, some of which are conducted during the night, are usually largely attended. In these courses the theoretical part of the syllabus is illustrated by lantern projections, and every facility for the study of the commercial analysis of wines as well as for microbiological examination and the analysis of soils is provided by well equipped laboratories. The technical part of the syllabus is usually demonstrated in a spacious courtyard, but there are annexed to it a model cave and fermenting rooms, as well as a small museum. A room is likewise set apart for the tasting of wines and is well supplied by the various types of wines manufactured in Spain.

The syllabus prescribed for these short courses are rather exhaustive, the subjects in the viticulture section being :

(1) Rural Economy as applied to viticulture, including a study of the various wine producing districts of Spain and their annual production.

(2) Ampelography, comprising the most important European cepages cultivated, and the American vines usually employed.

(3) Physiology of the vine and General Histology.

(4) Manures.

(5) Preparation of the soil before planting and cultivation of the vine.

(6) Various methods of grafting and pruning the vine.

(7) Diseases of the vine, non-parasitic as well as parasitic, and their treatment.

The subjects taught in the oenological section are :

(1) The buying, weighing and transport of grapes.

(2) The sifting and crushing operations.

(3) Correction of the musts for acidity and sugar.

(4) Sulphuration of the musts and removal of the excess of sulphur dioxide.

(5) Fermentation and its results.

(6) Effects of temperature, aeration and maceration.

(7) The preparation of white wines, red wines and « vinos rosados ».

(8) The keeping of wines and the devatting operations.

(9) Clarification, filtration and the diseases of wine.

(10) Pasteurization and commercial analysis.

The Colonial Research Committee under whose auspices this investigation has been conducted was appointed by the Secretary of State for the Colonies to conduct the administration of the Grant-in-Aid of Colonial Research, amounting to £100,000 in all, which is being made from the Imperial Treasury by instalments. The address of the Secretary to the Committee is the Colonial Office, London, S.W.1.

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